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Evaluation of Nova Scotia's Peatland Resources

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Alexander Anderson and Wayne Broughm

Abstract

This report presents the results of a five-year Peatland Inventory Program carried out by the Nova Scotia Department of Mines and Energy.

Nova Scotia has roughly 400,000-435,000 acres (162,000-175,000 ha) of peatland containing some 5.7 billion cubic yards (4.4 billion M^3) of peat. Of this resource, 2.4 billion cubic yards (1.8 billion M^3) are estimated to be "fuel grade" peat and 3.3 billion cubic yards (2.6 billion M^3) are "moss" or "surficial grade" peat. The resource is widely distributed in Nova Scotia, but the majority is concentrated in several regions, the largest of which are the three southwestern counties of Yarmouth, Shelburne and Queens.

The inventory program has identified sufficient fuel peat resources in southwestern Nova Scotia to warrant development of a fuel peat industry. Adequate peat moss resources exist in Hants County, Cumberland County, southwestern Nova Scotia and on Cape Breton Island, to support export production.

The report presents data on the peat resources in major areas of peatland concentration in Nova Scotia and in addition provides basic information on the natural development of peatlands, their economic and ecological value, current harvesting technologies, and climatic factors that may effect peat harvesting in Nova Scotia.

Preface

As the availability of liquid fossil fuels increased in the past century, the use of traditional fuels such as coal, wood, and peat declined substantially. This trend reversed abruptly when rising oil prices and a threatened supply made solid fuels and other indigenous sources of energy economically and strategically attractive alternatives to oil.

In response to the need to evaluate indigenous energy resources, the Nova Scotia Department of Mines and Energy in 1979 initiated an inventory program to delineate the Province's peat resources and define potential fuel peat reserves. The Peatland Inventory Program was designed to evaluate major peat deposits of Nova Scotia and to determine peat quality, quantity and composition in such a way as to allow an assessment based on a broad spectrum of criteria. The following report describes the major peat resources and their potential for development, discusses in broad terms peat production methods, and recommends future work on the Nova Scotia's peatland resource.

Chapter 1

Introduction

1.1 Uses of Peat

In recent decades, peatlands have been the focus of much interest because of their potentially arable land and for their fuel peat and peat moss resources. Traditionally peat has been used for domestic heating and cooking in Ireland, Finland, Scotland, Germany, and the U.S.S.R. where the peat or "turf" was cut by hand and dried for use during the winter months. Increased demand placed on peat as an energy source, and as an inexpensive soil conditioner, has led to the mechanization of peat "mining" or "harvesting" to provide greater annual production at lower cost. The demand for peat has grown with production capabilities and with the increased availability of a variety of enhanced peat-based energy products such as pellets, briquettes, charcoal, and metallurgical coke. Other enhancement processes such as carbonization, liquefaction, and gasification have led to the development of products used both in the energy and chemical industries.

By far the bulk of peat produced worldwide is used to generate energy or is being sold as peat moss. World peat production in 1980 was in the order of 200 million tonnes, most of which was produced in the U.S.S.R. (Table 1.1).

The U.S.S.R. is by far the world's largest producer and consumer of peat, using some 200 million tonnes per year. By 1978 the Soviet Union had more than 80 peat-fired generating plants with a total capacity of over 6500 MW. The largest single generating unit has a capacity of 600 MW. Peat is also used in the form of sods and briquettes for small industries and household heating (Monenco Ontario Limited 1981).

In Ireland, the Irish Electrial Supply Board (Bord na Mona) produces about 8 million tons (7 million tonnes) of peat annually for use in electrical generation and home heating. Roughly 440 MW of power, about 40 percent of demand, is generated annually in 20 thermal plants using peat. Bord na Mona produces roughly 410,000 tons (380,000 tonnes) of peat moss annually. Almost all (80%) of the peat moss produced in Ireland is exported to other countries (McNearney 1982).

Finland has approximately 25 million acres (10 million ha) of peatland (about half of its land area). Roughly 4 million tons (3.6 million tonnes) of peat are produced annually, 85 percent of which is used for primary energy generation and the remainder for peat moss. There are roughly 20 generating plants operating or under construction which use peat as a primary source of energy. Peat is used in milled, sod, briquette, and pellet form to supply many markets in the country (Asplund and Okkonen 1982).

Canadian peat resources exceed those of the U.S.S.R. yet we produce less than half of one percent of the world's peat moss and little or no peat for fuel.

Peat Moss Production

Peat production in North America, and in Canada in particular, is almost entirely for horticultural purposes. Canada produces some 880,000 tons (800,000 tonnes) of peat moss annually, most of which is exported to the United States, Europe, Africa and Japan (Bedard 1983; Statistics Canada 1985). Light fibrous peat moss is used as a growing medium, a soil conditioner, and as a component of products such as soil mixes, "grow boards", "grow bags", peat pots, and oil absorbents (Moores 1983). After the Second World War the number of Canadian peat moss producers doubled from 27 to 59 (Bedard 1983).

Bagged peat moss is commonly sold in 6 ft^3 (170 L) bales of compressed (2:1) product. Where peat is shipped over great distances the product can be compressed to 3:1 or even 7:1. Markets for Canadian peat moss are primarily in the United States (90-95%), Japan (3-5%) and Europe, Saudi Arabia, and Israel (Bedard 1983).

Soil mixes, fertilized peat, and "humus" or "composts" are derived from peat moss. They consist of varying amounts of added fertilizer, bark, perlite, vermiculite, or lime depending on the final product. Commonly sold in North America and Europe, these mixes are ideal for greenhouses and horticultural applications because they are considered "weed free" and have controlled nutrient levels to produce uniform plant growth (Bedard 1983).

Country	Peatland Area (ha × 10^6)	Peat Production (Tonnes × 10^3)		Total
		Fuel Peat	Moss Peat	
Canada	170.0	—	488	488
U.S.S.R.	150.0	80 000	120 000	200 000
U.S.A.	40.0	—	800	800
Indonesia	26.0	—	—	—
Finland	10.0	3 100	500	3 600
Sweden	7.0	—	270	270
China	3.5	800	1 300	2 100
Norway	3.0	1	83	84
Malyasia	2.4	—	—	—
U. K.	1.6	50	500	550
Poland	1.4	—	280	280
Ireland	1.2	5 570	380	5 950
West Germany	1.1	250	2 000	2 250
Total	417.2	89 771	126 601	216 372
Total Approx	420	90 000	130 000	220 000

Table 1.1
World peat resources and annual peat production (Kivinen & Pakarinen, 1980)

Peat pots, grow bags, and grow boards are specialty products that are fairly inexpensive and disposable making them attractive for domestic and some commercial gardening operations.

In Nova Scotia, one active peat moss producer working a deposit in the Annapolis Valley ships products such as compressed peat moss, soil mixes, and grow bags to the U.S. and Japan.

The production of peat moss and soil mixes in Nova Scotia was first initiated in Berwick at the current site of Annapolis Valley Peat Moss Limited in 1949. The initial production method was hand block cutting. After the peat had dried, it was shredded, cleaned, and bagged for shipment to markets in New England. Early peat production from the site was in the order of 2,000 to 5,000 bales annually. Vacuum harvesters were first used at the site in 1954 and production jumped to 35,000-50,000 bales. Current peat moss production, including soil mixes and various peat products, totals approximately 200,000 bales annually (pers. comm., Annapolis Valley Peat Moss Limited, 1986).

During the mid to late sixties, peat production on a limited scale was attempted by Eastern Peat Moss in Guysborough County. At least one bog in the Canso area and possibly a second bog in Country Harbour were harvested using wet harvesting and artificial drying to produce peat moss. However this operation lasted only a few years.

Fuel Grade Peat Production

Production of higher density or fuel grade peat is quite extensive in the U.S.S.R., Finland and Ireland. This form of peat is not often suitable for horticultural use because of its reduced water holding capacity. However, it is best suited for the production of energy or as industrial products.

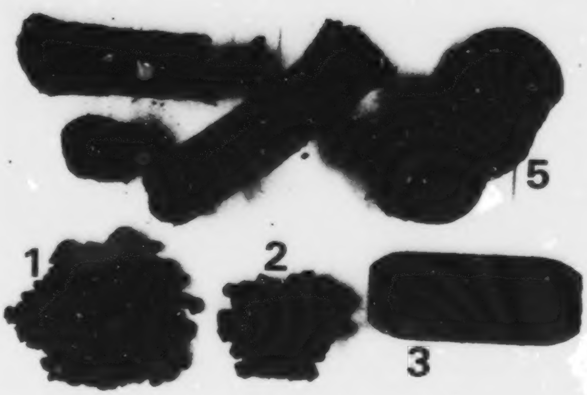

Figure 1.1
Peat products derived from fuel grade or humified peat.

The bulk of fuel peat production in countries such as the U.S.S.R., Ireland, and Finland, is used for thermal stations for the generation of electricity for central heating plants. The U.S.S.R. produces over 90 million tons (80 million tonnes) of fuel peat annually for energy production (Kivinen and Pakarinen 1980). Ireland is second in world peat production, deriving 20 percent of its national energy supply from peat. Finland derives about 3 percent of its energy supply from peat with its annual production exceeding 4 million tons (3 million tonnes) (Technopeat 1984; Kivinen and Pakarinen 1980).

In Europe, where large diverse markets exist, peat is processed into a number of energy products such as pellets, briquettes, charcoal, and metallurgical coke. (Figure 1.1).

The U.S.S.R. produces about 6 million tonnes of briquettes (Technopeat 1984), Ireland about 350,000 tonnes, and Finland about 100,000 tonnes (Asplund and Okkinen 1982) annually for sales in domestic markets. The production of high quality metallurgical coke from peat is possible due to the high reactivity and porous nature of the material. Peat coke is used for producing activated carbon and household barbeque briquettes and is preferred for non-ferrous electro-metallurgical processes (Fushman 1980).

Peat can also be enhanced through liquefaction and gasification processes that produce a number of by-products such as synthetic natural gas, methane, synthetic liquid fuels, and bitumen as well as base products for chemical processing such as phenols, tars, and waxes (Monenco Ontario Limited 1981; Fushman 1980).

Peat is also used in the distilling processes of some alcoholic beverages, and as a substrate for biomass cultivation (yeast, bacteria etc.) to yield medicinal and industrial products (Chornet 1984; Fushman 1980).

The production of sod and milled fuel peat is being carried out on a very limited scale in the Atlantic Provinces. Sod peat is currently used for home heating in eastern Newfoundland and milled peat has been used in a boiler of a pulp mill in the north central part of that province. With rising energy costs and increasing demand for energy, the Province of Nova Scotia has started to broaden its energy mix, looking at peat as a potentially viable fuel in industrial applications. The potential of this application is discussed in detail in Chapter 3.

1.1.2 The Peat Resource

World Peat Resources

Roughly 80 percent of the world's peatland resources can be found in Canada and the U.S.S.R. (810 million acres [320 million ha]) (Punwani 1980). World peat production in 1980 was nearly 240 million tons (216 million tonnes) of which 100 million tons (90 million tonnes) were used for energy production (equivalent to 152 million bbl oil) (Kivinen and Pakarinen 1980) (Tables 1.1 and 1.2).

Country	Resource Hectares ($\times 10^6$)	% of World Resources
Canada	170.0	41
U.S.S.R.	150.0	36
U.S.A.	40.0	10
Indonesia	26.0	6
Finland	10.0	2
Sweden	7.0	2
China	3.5	1
Norway	3.0	1
Malaysia	2.4	*
United Kingdom	1.6	*
Poland	1.4	*
Ireland	1.2	*
West Germany	1.1	*
Total	417.2	100

*Less than 1% of world resources
(Kivinen and Pakarinen [1980] from Monenco Ontario Limited [1981])

Table 1.2
World peat resources

Canadian Peat Resources

Peat can be found in all regions of Canada, from north to south and coast to coast. Canada has roughly 420 million acres (170 million ha) of peatland yet only 0.2 per cent of the world's peat production (Table 1.3).

Until recently, North American peatlands were generally considered to be wastelands. However, interest in peatlands increased in the post war period and a substantial peat moss industry developed in eastern North America, particularly in Quebec, New Brunswick, Maine and Nova Scotia (Bedard 1983).

Nova Scotia has approximately 400,000 acres (162,000 ha) of peatland (Table 1.4). Peat deposits are found throughout the Province, but the majority of the resource is concentrated in a small number of regions.

Province/Territory	Inferred Resource Hectares ($\times 10^3$)	% of Canadian Resources
Alberta	12 673	11
British Columbia	1 289	1
Manitoba	20 664	19
New Brunswick	120	
Newfoundland	6 429	6
NW Territories	25 111	23
Nova Scotia	158	
Ontario	22 555	20
P.E.I.	8	
Quebec	11 713	11
Saskatchewan	9 309	8
Yukon Territory	1 298	1
Total	111 328	100

(C. Tarnocai [1984], "Peat Resourcess of Canada")

Table 1.3
Canadian peat resources

County	Resource Area (Hectares)	% of Nova Scotia Resources
Yarmouth	9 843	6
Shelburne	25 640	16
Queens	19 031	12
Digby	7 852	5
Annapolis	15 715	10
Kings	4 451	3
Lunenburg	8 835	5
Halifax	14 114	9
Cumberland	5 984	4
Colchester	1 993	1
Hants	5 851	3
Pictou	1 818	1
Guysborough	14 403	9
Antigonish	922	1
Victoria	3 184	2
Inverness	6 187	4
Cape Breton	10 108	6
Richmond	5 879	3
Total	161 810	100

Table 1.4
Nova Scotia peat resources
(Nova Scotia Soil Surveys)

1.2 Peat and Peatlands

To most people, peat is the "peat moss" which they use in the garden as a soil conditioner or use directly as a growing medium for potting plants. But there is much more to peat than we meet in everyday experience. In the following section we outline in general terms the uses of peat, its global distribution, natural history of peat and peatlands, and aspects of the technology that currently exist for peat harvesting.

1.2.1 Peat

Origin
Peat is the partially decomposed remains of plants and animals which have accumulated in oxygen poor, water saturated freshwater environments. Nova Scotia deposits formed since the last glacial period (about 11-13,000 years ago) and have accumulated at a rate of 1 foot per thousand years (Auer 1930).

Partial decomposition of organic debris which occurs at the time of deposition is referred to as "humification". Humification is a decomposition and transformation process which breaks down the structural integrity of the parent organic material. In normal soil forming environments, humification transforms organic debris to "humus". However in a water logged environment, poor in nutrients and oxygen, the organic debris is transformed into "peat". Humification is believed to be the initial stage of coalification; in geological terms, peat is a very young coal (Kopstein 1979).

The availability of oxygen, nutrients, and water to the freshwater system where peat is forming, directly affects the chemical composition of the peat and the rate at which peat will accumculate. Poorly or weakly humified peat, commonly referred to as moss grade peat, can be orange-brown in colour and retain many of the characteristics of the organic material from which it formed (Figure 1.2).

Well humified peat (fuel grade) resembles dark brown to black muck (Figure 1.3). Its high bulk density and good combustion characteristics (Table 1.5) have led to its use as a fuel. The degree of humification of peat can be described on a scale of 1 to 10 using the "von Post" humification scale (see Chapter 2).

Constituents of Peat
Peat is commonly formed from *Sphagnum* moss, sedges (*Carex* spp), reeds, shrubs, wood, and other organic matter. Usually peat contains a mixture of organic remains which reflects the types of plants growing in the bog or wetland at the time of deposition.

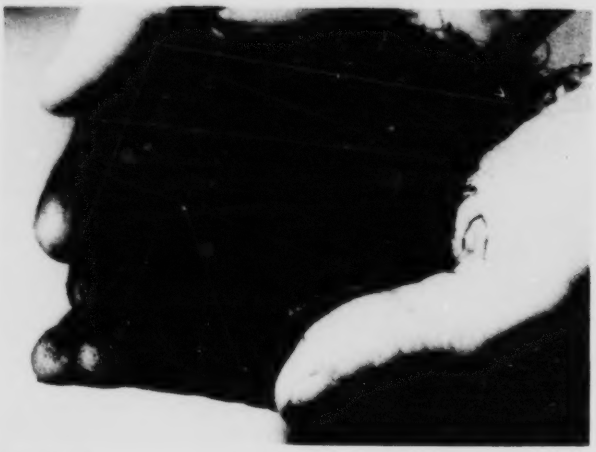

Figure 1.2
Poorly humified peat (peat moss).

Figure 1.3
Highly humified fuel grade peat.

	Moss Grade Peat	Fuel Grade Peat
Colour	light orange brown-dark brown	dark brown-black
Texture	rough, fibrous, bulky	smooth to rough, greasy matrix
Constituents	moss and plant structure quite evident	plant structure less evident; only shrub pieces and pieces of sedge can be noted
Bulk density	120-170 Kg/M^3 (50% M.C.)	300-400 Kg/M^3 (50% M.C.)
Heat Content	(7950-8200 BTU/lb) 4450-4550 Kcal/Kg	(8950-9500 BTU/lb) 4970-5280 Kcal/Kg

Table 1.5
Physical characteristics of peat moss and fuel grade peat (Nova Scotia Department of Mines and Energy Peatland Inventory data)

Mosses

Mosses, predominantly *Sphagnum* spp. are the major constituents of Nova Scotia peat. There are approximately 45 species of *Sphagnum* moss known to occur in North America of which 75-80 percent are found in Nova Scotia (Wolfgang Maas, National Research Council, Halifax).

Sphagnum moss plants grow from two inches to one foot in length. The longer species tend to be pioneer species which grow in the wettest portions of bogs, while shorter species can usually be found in the drier or more ombrogenic (nutrient poor) areas of the bog (Pollet 1968; Barber 1981). The moss plants usually form dense mats covering the entire surface of the bog.

Each moss plant has many branchlets arising in clusters around the stem. Each branchlet is covered with small leaflets. These leaflets remain in clusters along the stem beneath the surface of the bog as the moss plants grow. The only living part of the moss is the cluster of branchlets near the top of the plant (Figures 1.4 and 1.5).

The leaflets are composed of large hyaline hydrocysts, cells surrounded by smaller cells which contain the vital organs of the plant (Figure 1.4). The hydrocysts hold much of the plant's water. When the plant dies the small cells form canals or pores allowing movement of water and dissolved minerals between the large hydrocysts. The cells of the *Sphagnum* moss plant will hold up to 30 percent of the water in the moss while the other 70 percent is held in the extracellular spaces as well as between the leaflets (Scagel et al 1965).

Moss plants can retain up to 27 times their weight of water, (Swinnerton 1958). The fibrous nature, sterility, and water holding capacity of poorly humified *Sphagnum* peat moss make it an excellent soil conditioner. Peat can provide increased aeration or pore space in clayey soils, and increased water and nutrient retention in sandy soils (Leverin and Cameron 1949; Sutherland and Shea 1976).

Other mosses that contribute to peat formation occur in isolated instances in Nova Scotia. Members of the Order Bryales, *Dicranum* and *Polytricum*, have been catalogued at several sites. Bryales peats were found in poorly humified, nearly pure layers, near the bottom of the peat strata of a number of bogs.

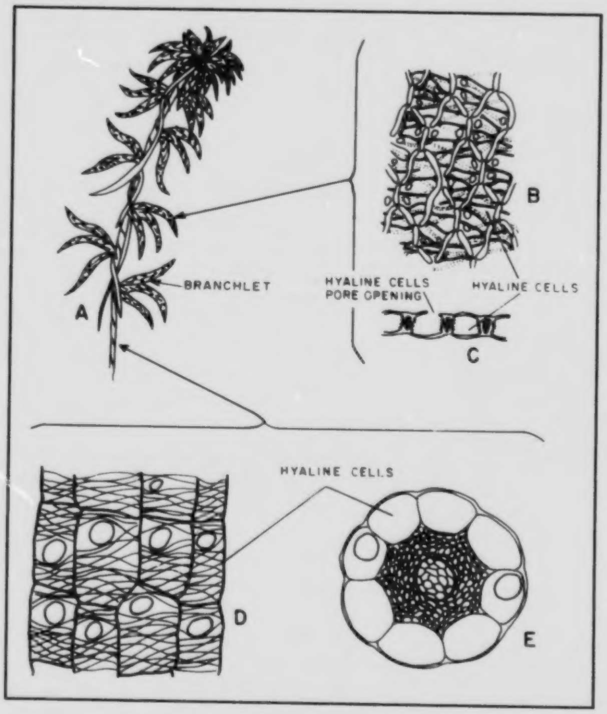

Figure 1.4
Morphology of *Sphagnum* mosses.

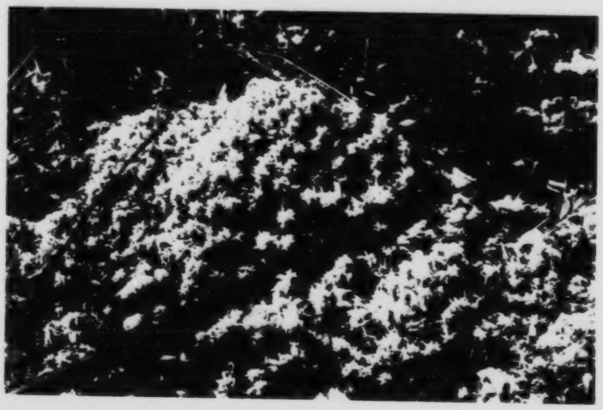

Figure 1.5
Sphagnum moss hummock.

Grass-like Plants

Several species of sedges, reeds, and grasses are found in peatlands in Nova Scotia. The most notable are deer-grass (*Scirpus caespitosus*), cotton-grass (*Eriophorum spissum*), white beak grass (*Rhycospora alba*), and several species of sedges (*Carex* spp.) (Figure 1.6).

These plants have variable amounts of lignin within their cell walls which make them resistant to breakdown in the humification process. Often the matrix of the peat is far more humified than the fibres of the sedge-like plants. This is particularly true where the roots of deer-grass (*Scirpus caespitosus*) are prevalent.

Sedge dominant peats are typically found in mineral rich peatlands or in the lower strata of *Sphagnum* dominated bogs. These peats are generally accompanied by minor occurrences of shrubs or pieces of wood and tend to be poorly humified. Sedge peats have a low water retention capability but have a fairly high bulk density which tends to increase their potential for use as fuel rather than for horticultural applications.

Shrubs and other Woody Plants

These are minor constituents in most peat types. The remains of woody plants occur thoughout the entire peat depth profile. The most common are ericaceous shrubs such as sheep laurel (*Kalmia* spp.), leatherleaf (*Chamaedaphne calculata*), rhodora (*Rhododendron canadense*) and labrador tea (*Ledum groenlandicum*) (Figure 1.7). Woody plant remains found in peat are derived from trees or tall shrubs, usually black spruce (*Picea mariana*), larch (*Larix larcina*), red maple (*Acer rubrum*), or speckled alder (*Alnus rugosa*), which grew in the peatland at the time of deposition. The occurrence of these remains in large quantities in the peat tends to lower the economic potential of the deposit for either peat moss or fuel peat.

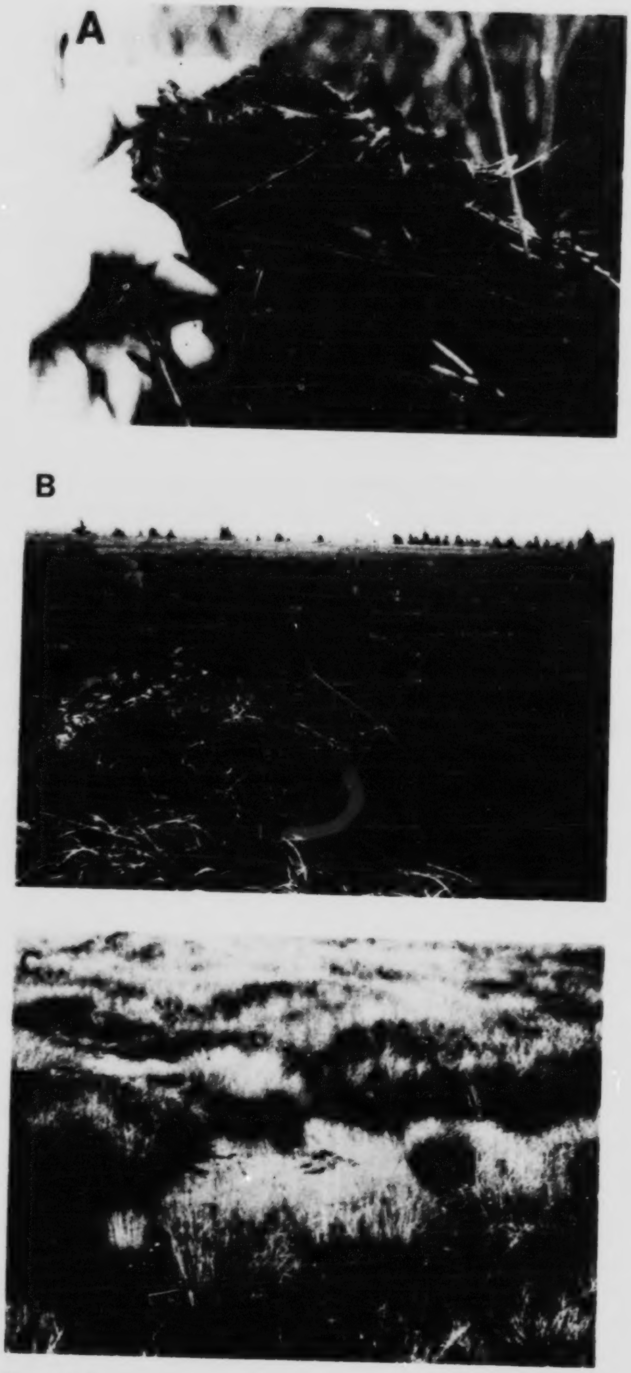

Figure 1.6
Grass-like plants. A. Reed-sedge peat (shallow marsh). B. *Carex* species (graminoid fen). C. Deergrass (*Scirpus caespitosus*) (graminoid bog).

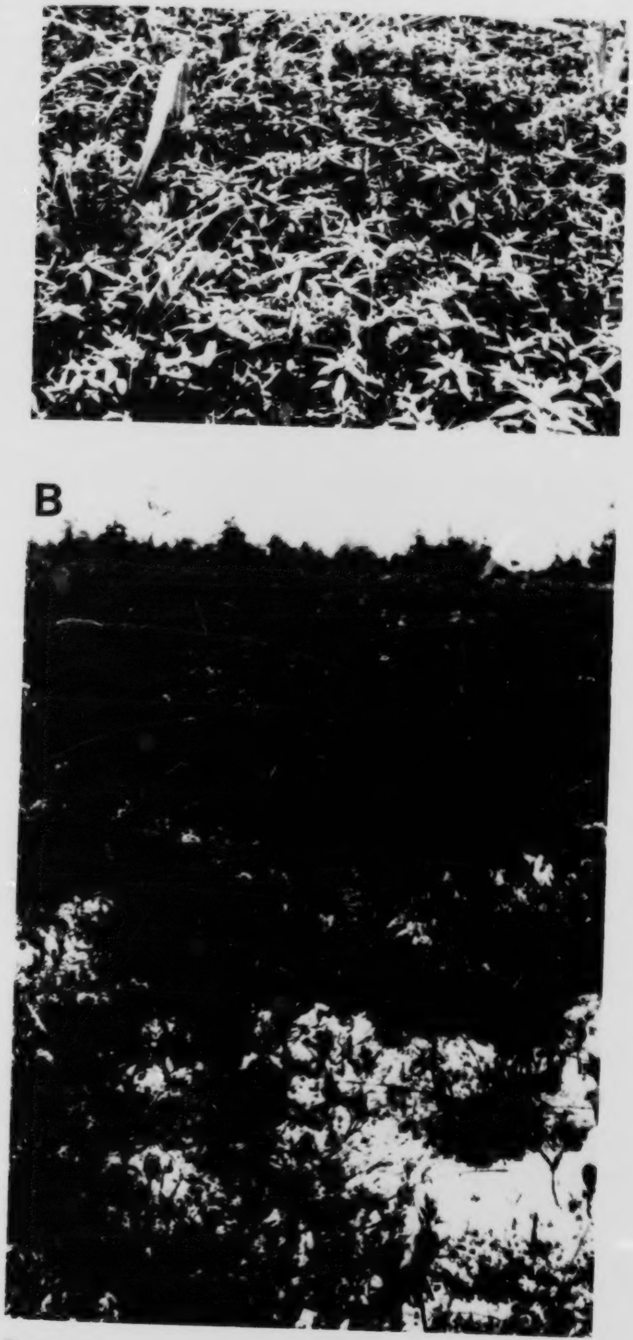

Figure 1.7
Shrubs and woody plants. A. Bog laurel (*Kalmia* spp.) and Leatherleaf (*Chamaedaphne* spp.), low shrub bog. B. Labrador tea (*Ledum groenlandicum*), low shrub bog.

1.2.2 Nova Scotia Peatlands

Peatlands are a type of wetland in which peat has accumulated to form a substantial layer. Familiar terms for these areas are "bogs", "swamps", "savannahs", "heaths", and "meadows".

Development or formation of a peatland takes place in two phases, infilling, and expansion. "Infilling" is the primary or initial successional stage which leads to the development of an organic mat within a wetland system (Auer 1930; Moore and Bellamy 1974). For the purposes of this report, peat accumulations within a body of water or wetland are not considered peatlands until they reach the surface of the water table and exceed one foot (30 cm) in depth. Once accumulation exceeds the level of the water table the "expansion" phase of the peat deposit begins.

Peat growth above the original water table or water level will retain precipitation, or by capillary action draw water upward, maintaining the water table just beneath the surface of the peatland. As peat accumulates, the water table rises. The deposit thus raises the water table near its margin. The change in water level at the peatland margin causes "paludification" of the surrounding soil, a lateral expansion of the peat deposit (Auer 1930) (Figure 1.8). This is the primary stage where peatland differentiation takes place (Moore and Bellamy 1974).

There are three basic peatland forms found in Nova Scotia; bogs, fens, and swamps. The distribution of the peatlands is related to the topography, drainage, and, to some extent, the climate of the region (Figures 1.9 and 1.10).

Bogs

The most common peatlands in Nova Scotia are "bogs". Bogs are relatively nutrient poor and acidic accumulations of peat derived from *Sphagnum* moss and other minor plant debris. Several bog types occur in the Province, ranging from extensive blanket bogs in northern Cape Breton to small flat deposits found throughout Nova Scotia (Figures 1.10 and 1.11).

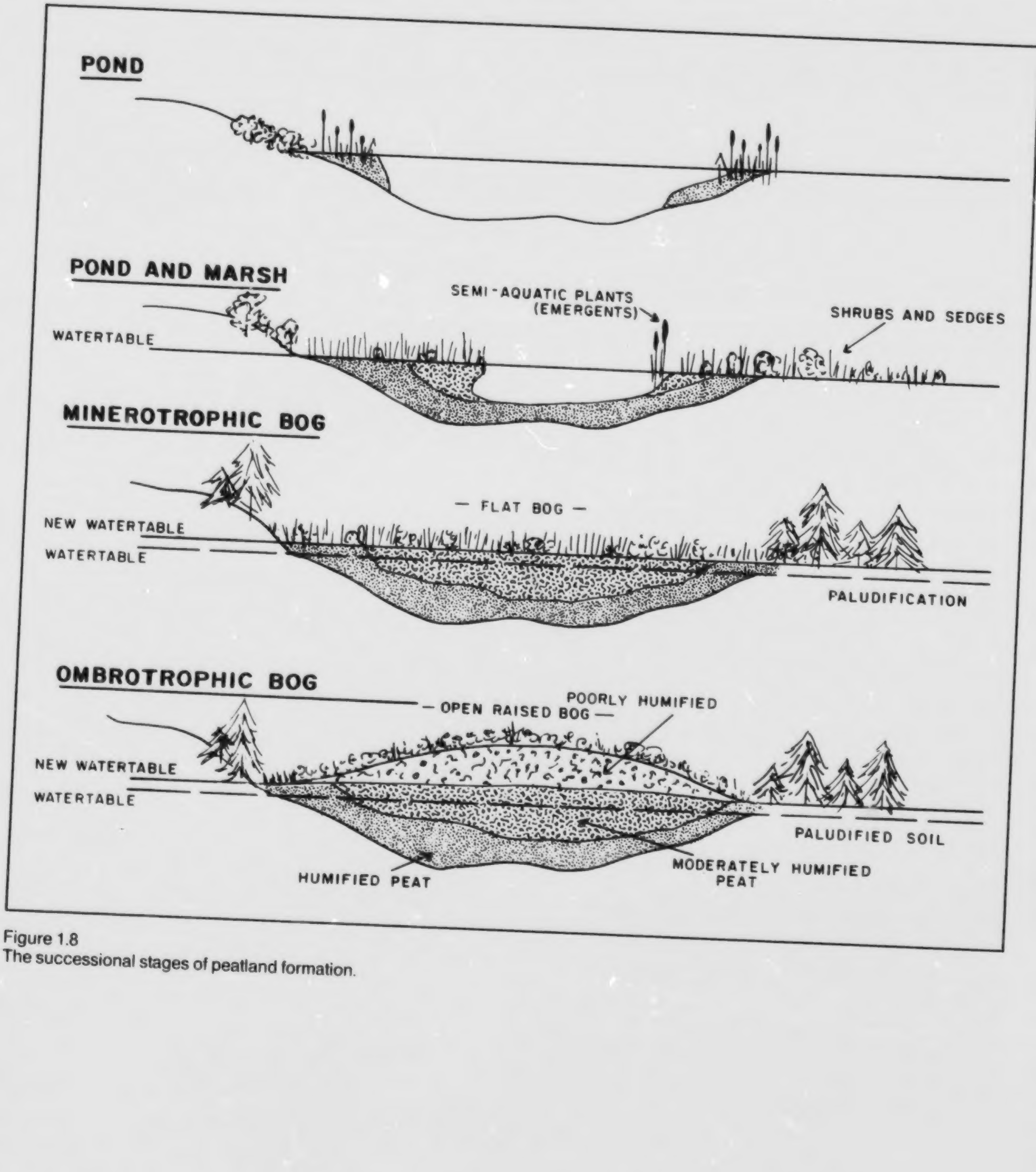
POND
POND AND MARSH
SEMI-AQUATIC PLANTS (EMERGENTS)
SHRUBS AND SEDGES
WATERTABLE
MINEROTROPHIC BOG
— FLAT BOG —
NEW WATERTABLE
WATERTABLE
PALUDIFICATION
OMBROTROPHIC BOG
— OPEN RAISED BOG —
POORLY HUMIFIED
NEW WATERTABLE
WATERTABLE
PALUDIFIED SOIL
HUMIFIED PEAT
MODERATELY HUMIFIED PEAT

Figure 1.8
The successional stages of peatland formation.

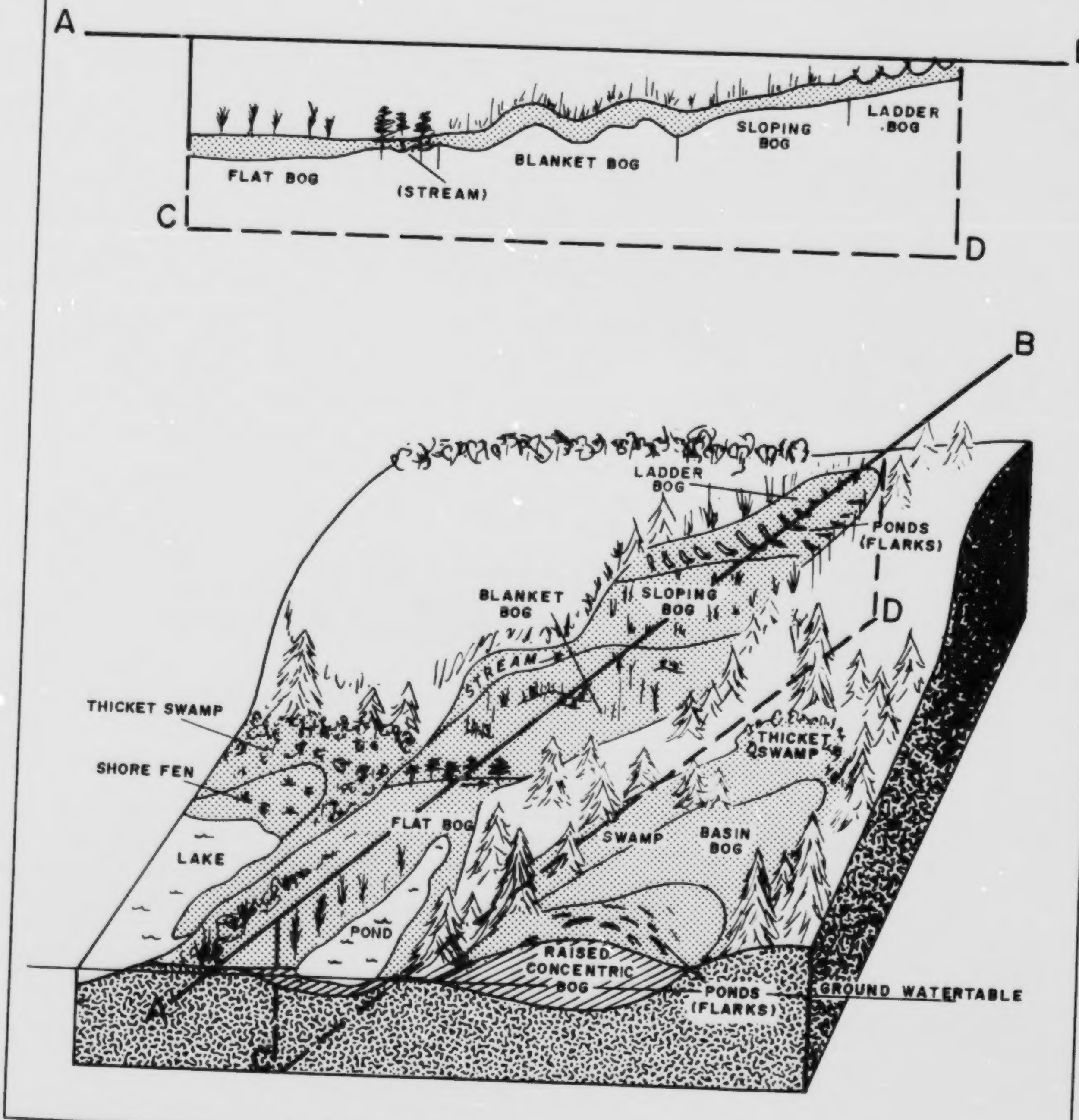
A
B
FLAT BOG
(STREAM)
BLANKET BOG
SLOPING BOG
LADDER BOG
C
D
B
LADDER BOG
PONDS (FLARKS)
BLANKET BOG
SLOPING BOG
D
STREAM
THICKET SWAMP
SHORE FEN
THICKET SWAMP
FLAT BOG
SWAMP
BASIN BOG
LAKE
POND
RAISED CONCENTRIC BOG
PONDS (FLARKS)
GROUND WATERTABLE
A
C

Figure 1.9
Typical peatland formations.

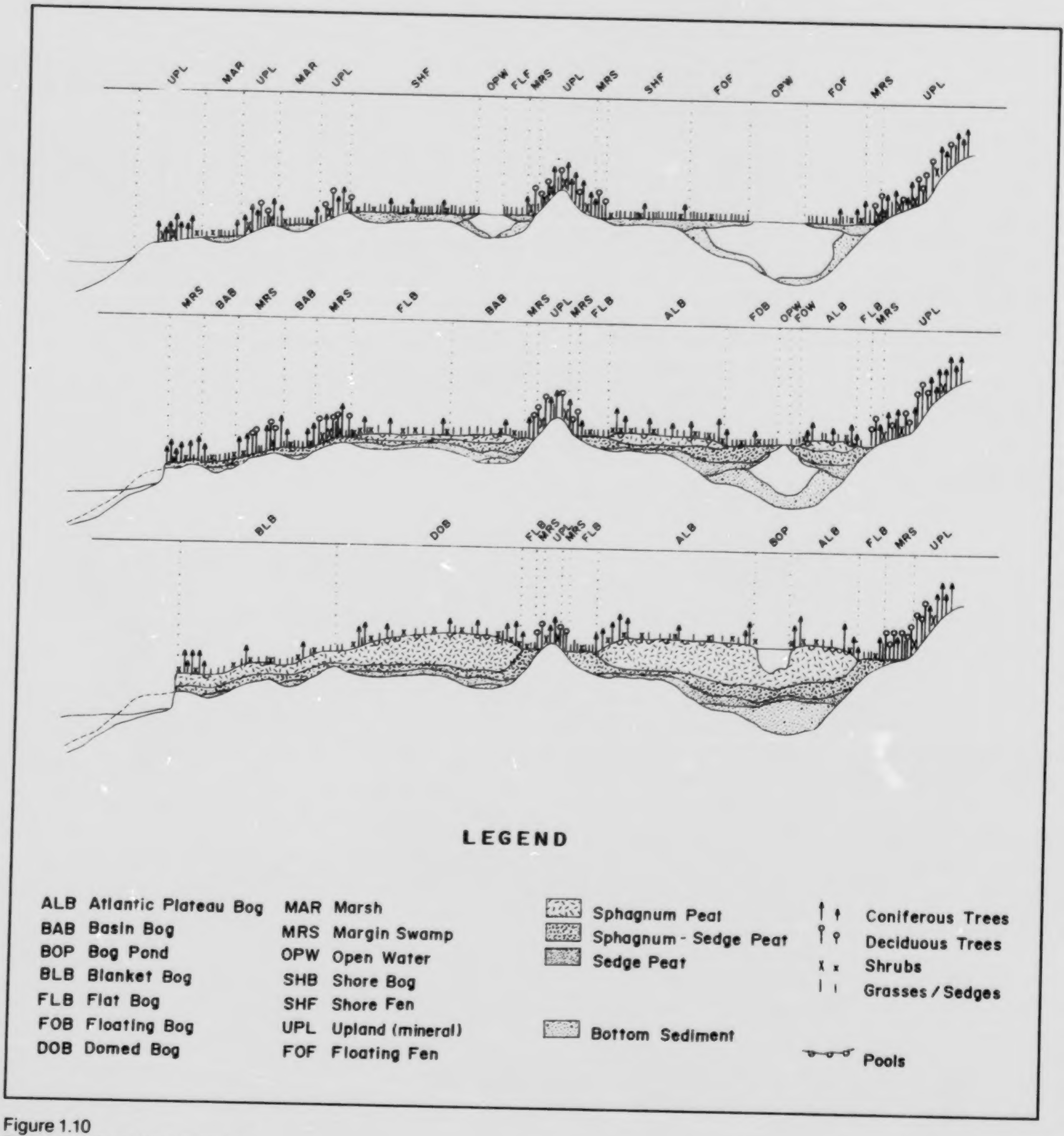
UPL MAR UPL MAR UPL SHF OPW FLF MRS UPL MRS SHF FOF OPW FOF MRS UPL
MRS BAB MRS BAB MRS FLB BAB MRS UPL MRS FLB ALB FOB OPW FOW ALB FLB MRS UPL
BLB DOB FLB MRS UPL MRS FLB ALB BOP ALB FLB MRS UPL
LEGEND
ALB Atlantic Plateau Bog
BAB Basin Bog
BOP Bog Pond
BLB Blanket Bog
FLB Flat Bog
FOB Floating Bog
DOB Domed Bog
MAR Marsh
MRS Margin Swamp
OPW Open Water
SHB Shore Bog
SHF Shore Fen
UPL Upland (mineral)
FOF Floating Fen
Sphagnum Peat
Sphagnum - Sedge Peat
Sedge Peat
Bottom Sediment
Coniferous Trees
Deciduous Trees
Shrubs
Grasses / Sedges
Pools

Figure 1.10
Dynamics of peatland formation.

Raised or Domed Bogs

As a peatland develops in size and depth, vegetation growing near the centre becomes partially isolated from nutrient influx from groundwater systems. There is a gradual replacement of minerotrophic mosses and plants with more ombrotrophic plants (plants which obtain their nutrient needs from precipitation, rain, or snow melt) (Dansereau and Segados-Vianna 1952). Oxygen and nutrient deficient water from precipitation and the consequent slow biological degradation results in the "rapid" accumulation of poorly humified peat, creating a dome or raised centre in the bog (Auer 1930; Dansereau and Segados-Vianna 1952; Moore andBellamy 1974; Barber 1981).

Domed bogs occur throughout Nova Scotia. The change in elevation from the margin to the centre of the bog may only be a few feet (1 m) to as much as 12-15 feet (4-5 m) depending on the stage of development and the physiography of the region. In domed bogs the slope is usually fairly constant from the margin to the centre (Figure 1.9).

"Coastal Raised Bogs" or "Atlantic Plateau Bogs" are common in the southern coastal regions of the Province. Found primarily along the coast, they are typically different from domed bogs in that their domes are "steep" sided, rising up to 12 feet (4 m) within a few hundred feet of the bog margin. They then level out like a plateau with only a slight rise towards the center.

Flat Bogs

Flat bogs (Figures 1.10 and 1.11) are rarely truly flat and usually slope slightly from one margin to the next. These deposits are found throughout Nova Scotia and may be considered as weakly developed or immature bogs. Although flat bogs may have begun to form at the same time as raised deposits,they do not have thick accumulations of peat-a result of unfavourable topography or environmental conditions. Generally, flat bogs are moderately shallow (3 to 10 feet (1 to 3 m) in depth), and tend to be fairly minerotrophic, often associated with high ground water systems and flowing or open bodies of water. Several types of flat bogs are found in Nova Scotia of which basin bogs, shore bogs, and stream bogs are the most common.

Sloped Bogs

Peat accumulating on inclined terrain often develops into a "sloped" bog. Peat depth may often be fairly uniform throughout the deposit, ranging from 3 to 10 feet (1 to 3 m) in depth. Sloping bogs often develop striking surface patterns of vegetation and ponding. A similar or related type of patterning is often found on raised bogs and some types of fens (Figures 1.9 and 1.10).

Sloped bogs are usually restricted to areas with cool, moist, climate where there is poor to imperfect drainage, allowing peat to accumulate on the side of a hill or in shallow seepage tract. A number of sloped bogs are found in Cape Breton and Guysborough County.

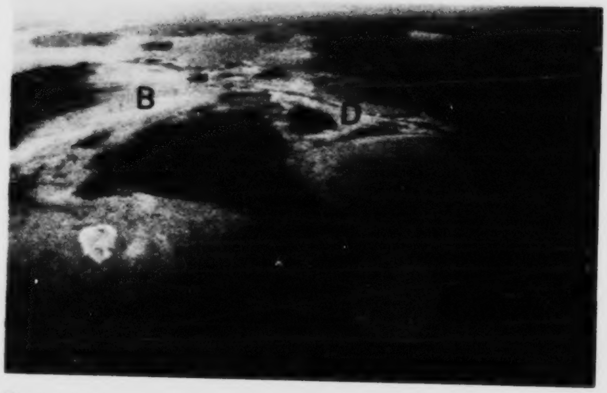

Figure 1.11
Peatland complex. A. Slightly domed bog. B. Flat bog. C. Peat margin swamp. D. Stream fen.

Blanket Bog

Blanket bogs are usually restricted to areas of relatively thin soils, in cooler and wetter areas of the Nova Scotia (chiefly the Atlantic coast from Halifax to Sydney and Cape Breton Highlands). Peat deposits in blanket bogs are usually quite shallow, rarely exceeding 6 feet (2 m) except where ombrotrophic domes have formed. Blanket bogs differ from sloped and flat bogs in that they follow the contour of the land, have fairly constant depth, and cover the mineral terrain like a "blanket" (Figures 1.9 and 1.10). Quite often blanket bogs have large rocks protruding through their surface and have numerous ponds.

Fens

The primary difference between bogs and fens, according to Jeglum *et al.* (1974), is the type of vegetation contributing to the peat matrix. In fens, the primary forms of vegetation are comprised of sedges, grasses, and reeds mixed with shrubs and minor amounts of mosses, usually *Hypnum* (brown) mosses. In bogs, the primary component is *Sphagnum* moss.

In North America, minerotrophic bogs may also be called fens (Davis *et al.* 1985). Fens may be sloped but normally are flat and very minerotrophic.

From sampling data collected during the present survey program it was evident that fens were common in the early development of peatlands. Thick layers of sedge dominated peat were found at the bottom of many deposits. Although less common today, most fens in the Province border on, or are near, flowing or open bodies of water (Figures 1.10 and 1.12).

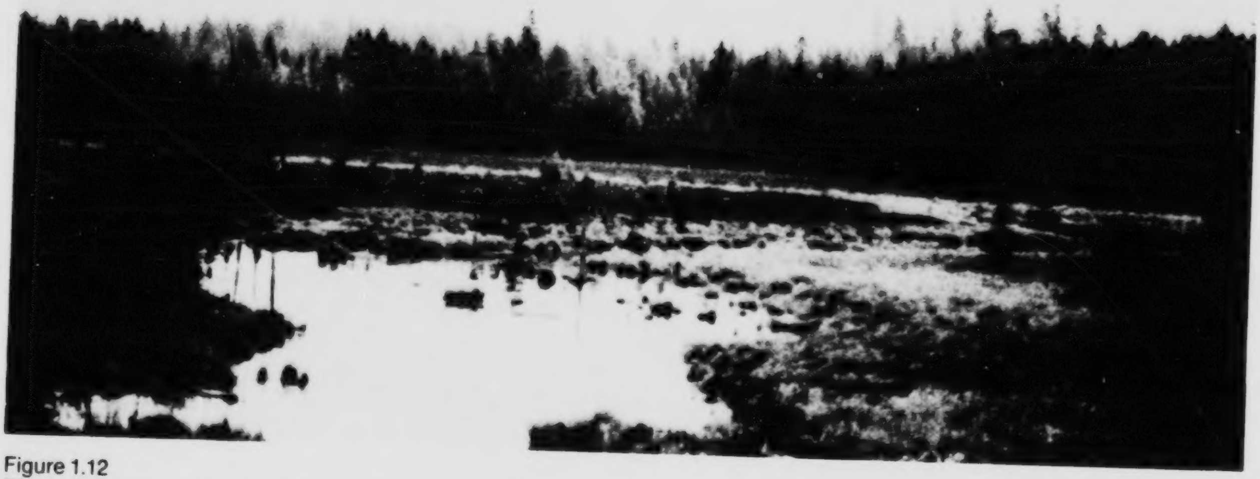

Figure 1.12
Stream fen at margin of a flat bog in Hants County.

Swamps

Swamps and thicket swamps are often nutrient rich peatlands dominated by a standing cover of merchantable trees (Figures 1.10 and 1.13). Thicket swamps are peatlands dominated by tall shrubs such as alders (*Alnus* spp.) or similar plants. These peatlands receive frequent inundations of mineral rich waters from streams and/or runoff. They can be found throughout Nova Scotia in poorly drained sites near streams and lakes or at bog margins. They can also be found in hollows or on poorly drained slopes. Peat depth is usually very shallow, usually no more than 3 feet (1 m).

Figure 1.13
Peat margin swamp (mixed), Yarmouth County.

Chapter 2

The Nova Scotia Peatland Inventory Program

2.1 Introduction

The Nova Scotia Department of Mines and Energy initiated the Nova Scotia Peatland Inventory Program in 1979 in response to a need for information on this potentially valuable but yet poorly documented resource in the Province.

Nova Scotia's peat resources have been studied intermittently since the early part of this century, especially with regard to their horticultural potential. However, these studies were either limited in scope, designed to gather information only on specific sites, or dealt with specific information not entirely suitable for complete resource evaluation (Auer 1930; Leverin 1946; Leverin and Cameron 1949).

Early resource estimates indicated the presence of as little as 25,000 acres (10 000 ha) of peatland in Nova Scotia (Tibbetts and Fraser 1978; Monenco Ontario Limited 1981), even though soil surveys in the 1950's and 1960's identified approximately 400,000 acres (162,000 ha) of organic soil in the Province.

In general, early peatland studies had been designed either to look specifically at individual deposits or to evaluate particular aspects of the resource, rather than to provide an overview. Deposits inventoried prior to 1979 are shown on Figure 2.1.

Field work in the inventory program was initiated in the spring of 1980. Because of the regional distribution of the peatlands in Nova Scotia, it was possible to set up a comparatively small number of study areas which would encompass the majority of the peat resource (Figures 2.2 and 2.3). The aim of field studies was to survey the larger or the more representative deposits in each of the chosen study areas.

Throughout the program, information on peat quality, quantity, and composition, was gathered, processed and stored with a view to permitting a broad spectrum of peat assessment criteria to be derived from it. Thus, although the main aim of the program was to assess fuel peat potential, data has been gathered which are suitable for the evaluation of other uses of the resource, such as peat moss harvesting or production of agricultural crops.

In addition, information collected during the survey has been compiled into a computer data base for easy retrieval and processing to provide area, volume, and tonnage estimates and a variety of other resource parameters which will be described in greater detail in the following sections. Sampling data can be retrieved from the data base in a graphic form as profiles or in "tabular report" form depending on the user's preference. Survey data has also been plotted on a series of 1:10,000 line maps showing the peatland margins, access, sampling sites, and tabular resource information.

As a whole the inventory data collected provides a first pass,comprehensive look at the resource and should prove to be a reliable indicator of areas where potential peat reserves may lie.

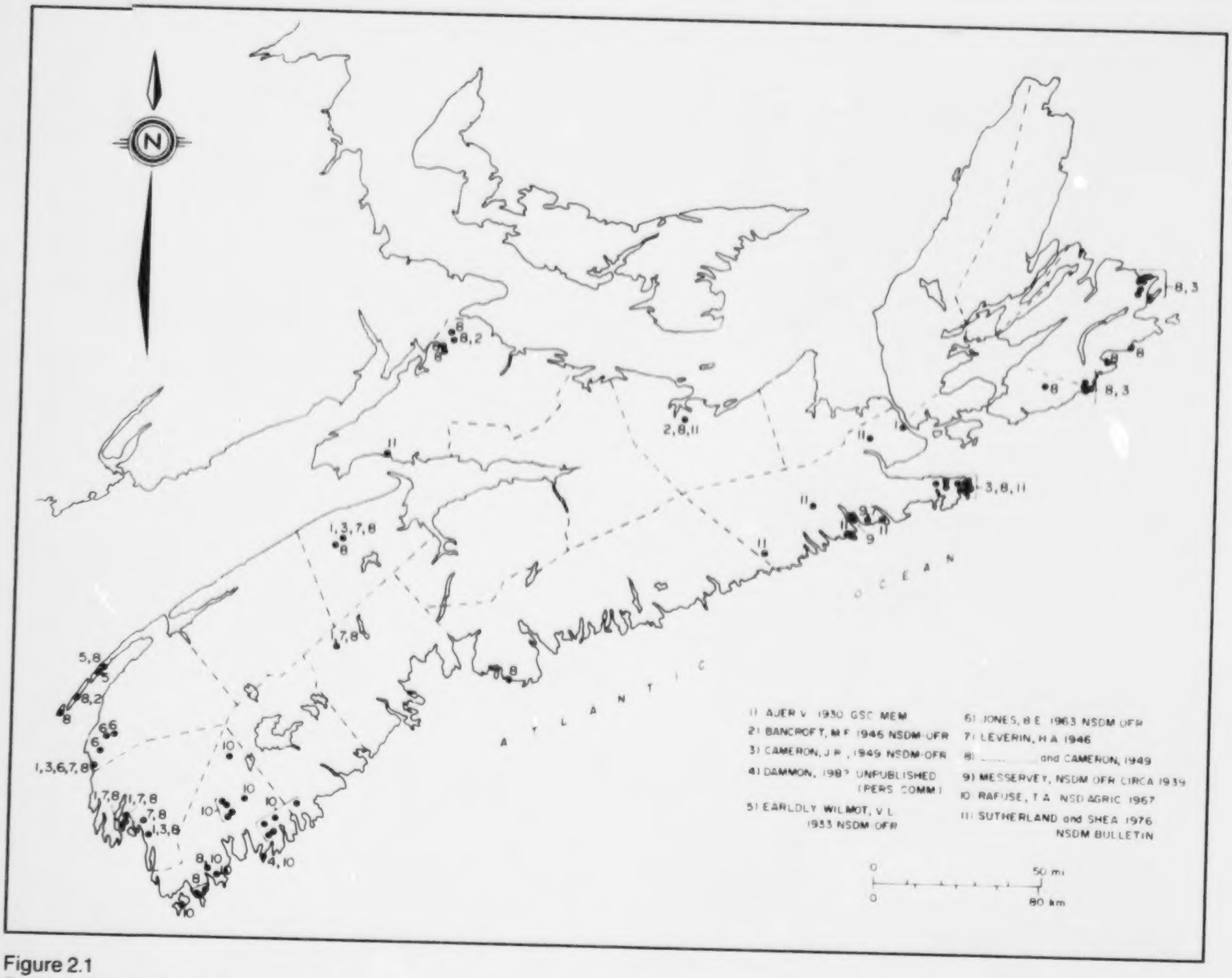
N
ATLANTIC OCEAN
1) AJER V. 1930 GSC MEM
2) BANCROFT, M.F. 1946 NSDM-OFR
3) CAMERON, J.R., 1949 NSDM-OFR
4) DAMMON, 198? UNPUBLISHED (PERS. COMM.)
5) EARLDLY WILMOT, V.L. 1933 NSDM OFR
6) JONES, B.E. 1963 NSDM OFR
7) LEVERIN, H.A. 1946
8) ______ and CAMERON, 1949
9) MESSERVEY, NSDM OFR CIRCA 1939
10) RAFUSE, T.A. NSD AGRIC 1967
11) SUTHERLAND and SHEA 1976 NSDM BULLETIN
0
50 mi
0
80 km

Figure 2.1
Early studies on the peat resources of Nova Scotia.

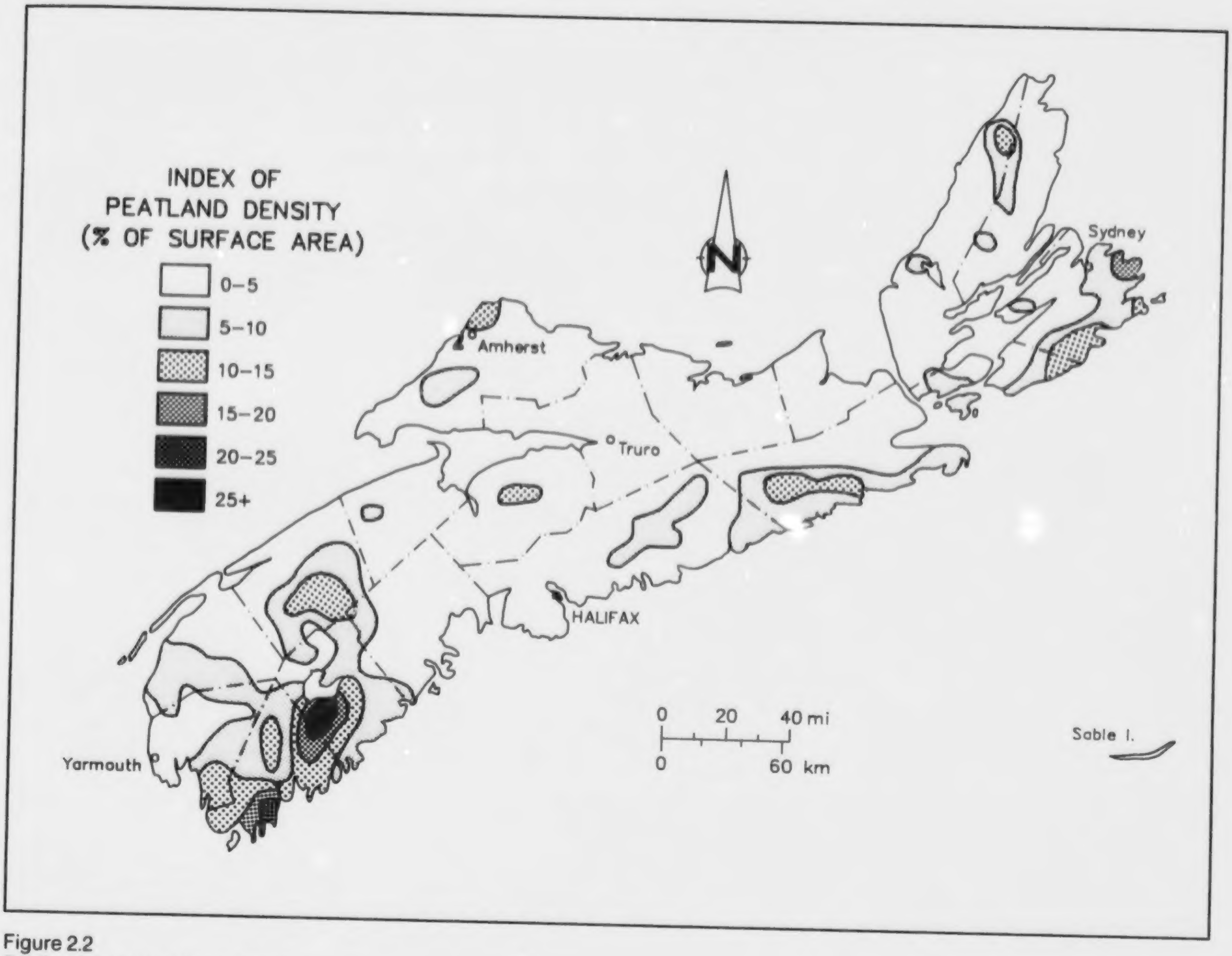
INDEX OF
PEATLAND DENSITY
(% OF SURFACE AREA)
0–5
5–10
10–15
15–20
20–25
25+
N
Amherst
Truro
HALIFAX
Sydney
Yarmouth
Sable I.
0 20 40 mi
0 60 km

Figure 2.2
Peatland density of Nova Scotia.

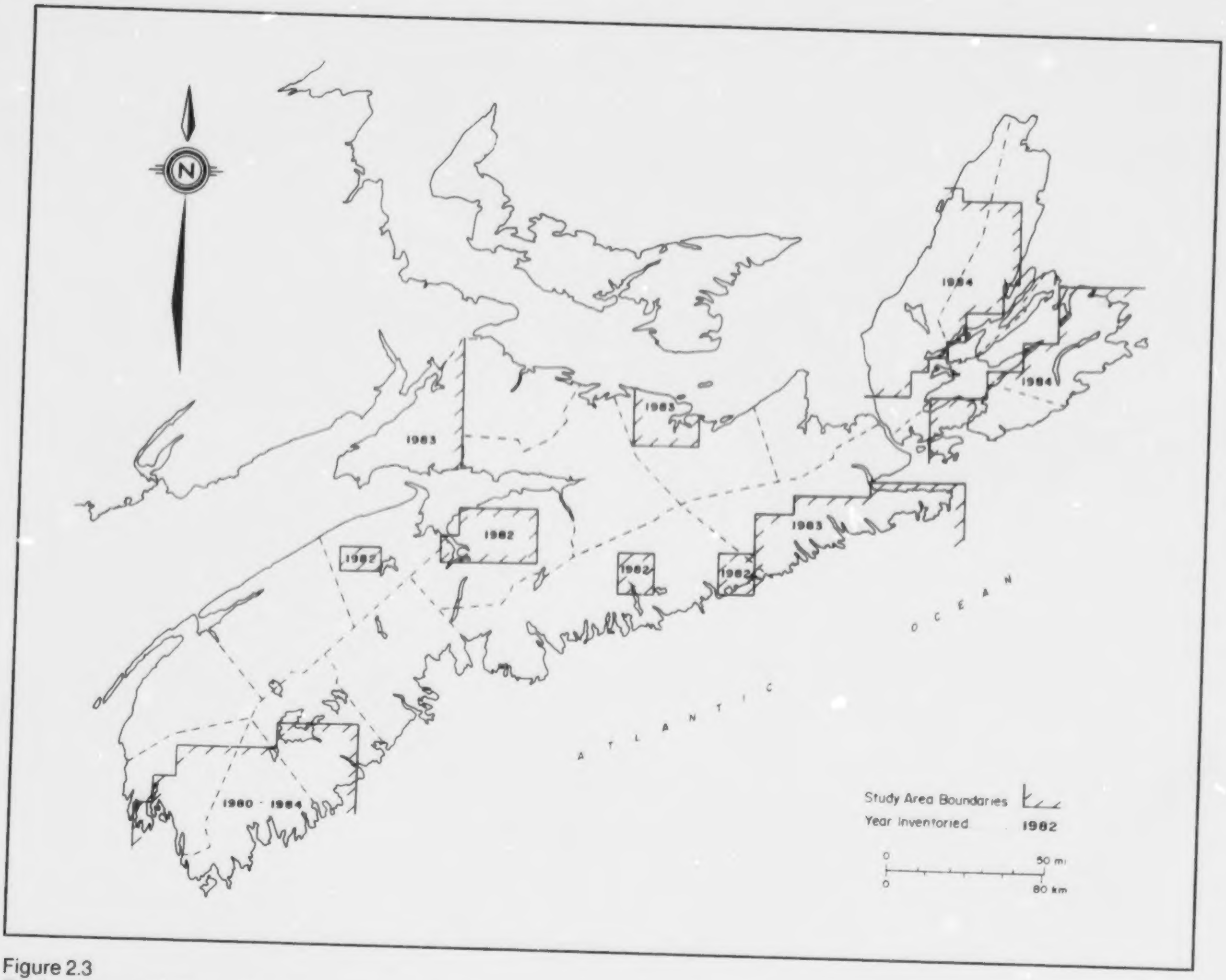
N
1984
1983
1983
1984
1982
1982
1983
1982
1982
ATLANTIC OCEAN
1980 - 1984
Study Area Boundaries
Year Inventoried 1982
0 50 mi
0 80 km

Figure 2.3
Peatland Inventory Program study areas.

2.2 Inventory Procedures

Survey methods used during the program were based on a system developed by the Geological Survey of Finland and recently modified and used by the Department of Natural Resources, Province of New Brunswick. The system has been called the "Modified von Post System" and was described by Korpijaakko and Pheeny (1972) and in considerable detail by Keys and Henderson (1983). The method used here follows Keys and Henderson (1983).

2.2.1 Site Selection and Sampling Design

All aerial photographs (scales 1:10 000 and 1:15 840) for each of the areas to be investigated were examined to identify all peatlands greater than 50 hectares in size. Peatlands smaller than 50 hectares were to be sampled only if associated with larger deposits or if considered unique or representative of a particular area.

Deposits chosen in each area were then examined in stereo on aerial photographs to aid in the preparation of a preliminary plan or survey grid of sampling points. Survey traverse and grid points were positioned to provide greater sampling intensity in central areas of the deposits where the peat was likely to be thicker. In this way a maximum amount of information could be gathered from a minimum number of sampling points. Large deposits could have as many as three grid systems, each having a baseline and a series of cross lines (Figure 2.4). Baselines were planned to extend along the longitudinal axis of the deposit, crossing the centers of peat domes or deepest parts of the bog. Cross lines were established across base lines or other cross lines at 450-650 yard (400-600 m) intervals. Traverse points (non-grid sampling points) were located in key areas of the deposit not accessed by grid lines. Deposits too small for a detailed grid system (usually those smaller than 100 ha) were surveyed entirely with traverse points placed where the thickest peat layers were expected. A preliminary survey grid pattern used in the field planning stage for deposit "V0904", on Baccaro Point, Shelburne County, is presented in Figure 2.4. Sampling points planned in this manner were often subject to minor changes in the field depending on ground conditions.

2.2.2 Bog Survey Procedure

Bog Identification and Site Coding

Bog Identification Number

Survey sites were identified by both a deposit number and a sampling site number. Each bog surveyed was given a unique code number that allows it to be readily located using the map sheet numbers on the Nova Scotia Department of Lands and Forests, Forest Covertype Inventory Maps. Deposits were numbered sequentially from west to east and north to south on each mapsheet. As an example, the twelfth deposit delineated on sheet "Q-11" would be coded "Q11-12". Smaller deposits associated with a large bog would often be given an appended letter code (ie. Q11-12a). A special "G" code appended to the bog's identification number indicates a group or cluster of deposits which have been sampled and listed as one deposit. This became necessary in areas such as Guysborough County and Cape Breton Island where a large number of small deposits were found, forming significant peat accumulations. Other subletter codes indicate that a deposit is associated with a nearby larger deposit. From 1980 to 1982 all peat deposits on a map sheet were numbered but subsequently only bogs sampled by the inventory program were numbered.

Site Coding

The system of survey site and line coding used in this program varies slightly from that described by Keys and Henderson (1983) for New Brunswick peatlands. Line cutting crews used three codes (B, F, or H) to denote primary, secondary, or tertiary grid base line points. Cross line points associated with any of these base lines (B, F, or H) were then denoted with one of the other codes (L, G, or I) to denote primary, secondary, or tertiary cross line points (Figure 2.5).

For example, a site 1200 meters northward from the primary base line origin "BOON" is referred to as "B120N". A cross line site 900 meters eastward from this "B120N" site would be recorded as "B120N090E". Sites on secondary crosslines, originating from this point, are appended in the same manner. Thus "B120N090E070S" represents a site 700 meters south on the "B120N090E" crossline. For mapping purposes these codes are shortened and only end points are labelled. Because the "B120N090E070S" site occurs on a secondary cross line, it would be labelled as "G900E + 700S" (Figure 2.5).

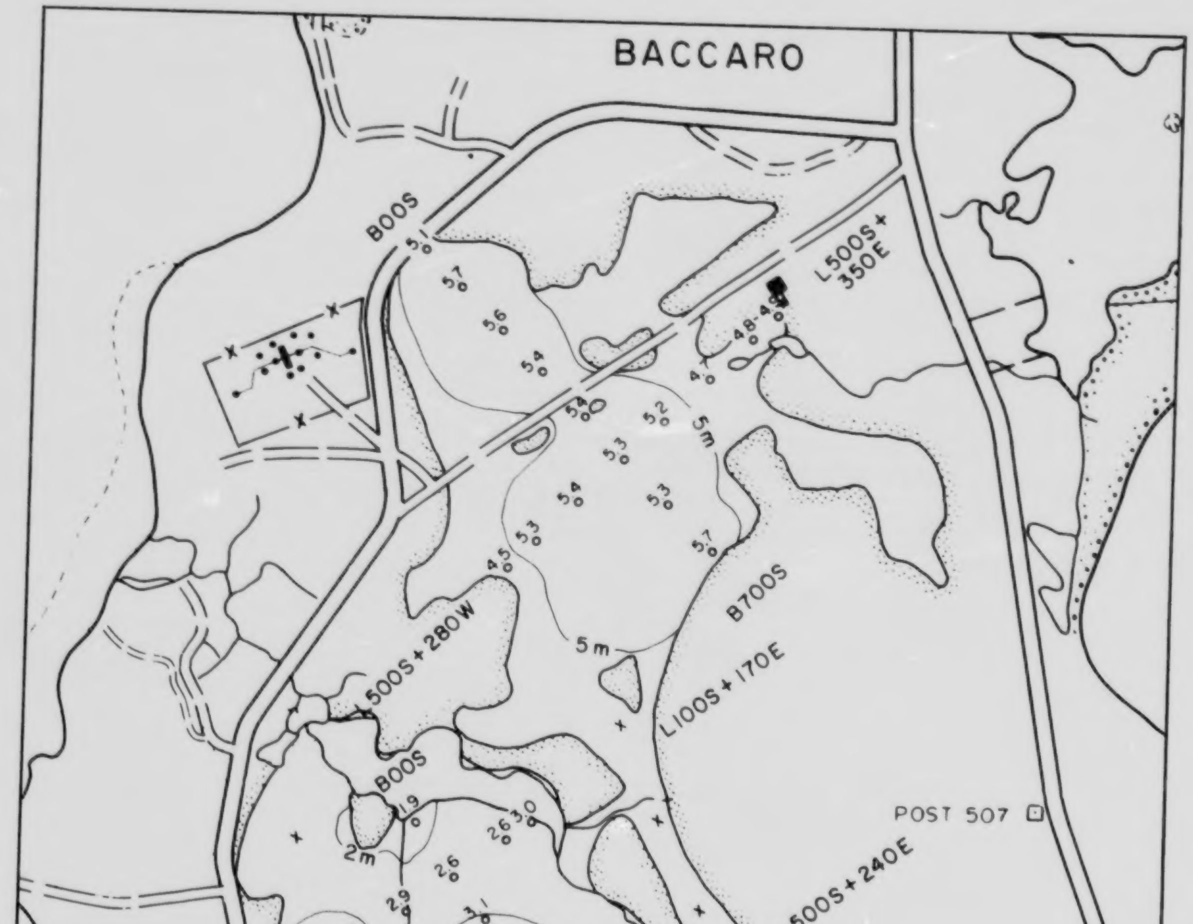
BACCARO
B00S
L500S+350E
4.8
4.9
5.1
5.7
5.6
5.4
4.7
5.4
5.2
5m
5.3
5.4
5.3
4.5
5.3
5.7
B700S
500S+280W
5m
L100S+170E
B00S
1.9
2m
2.6
3.0
2.6
2.9
3.1
POST 507
L500S+240E
3.2
3.2
3.4
3m
2.4
3.8
3.9
4m
3.6
L800S+320E
L100S+370W
4.3
4.2
4.3
4.5
3.9
4.2
3.9
4.7
4.5
L500S+180W
5.2
5m
4.8
4.8
4.5
4.3
4.2
4.8
4.6
3.9
4.9
B1270S
L800S+350W

Figure 2.4
Sampling grid and traverse points used on bog V0904.

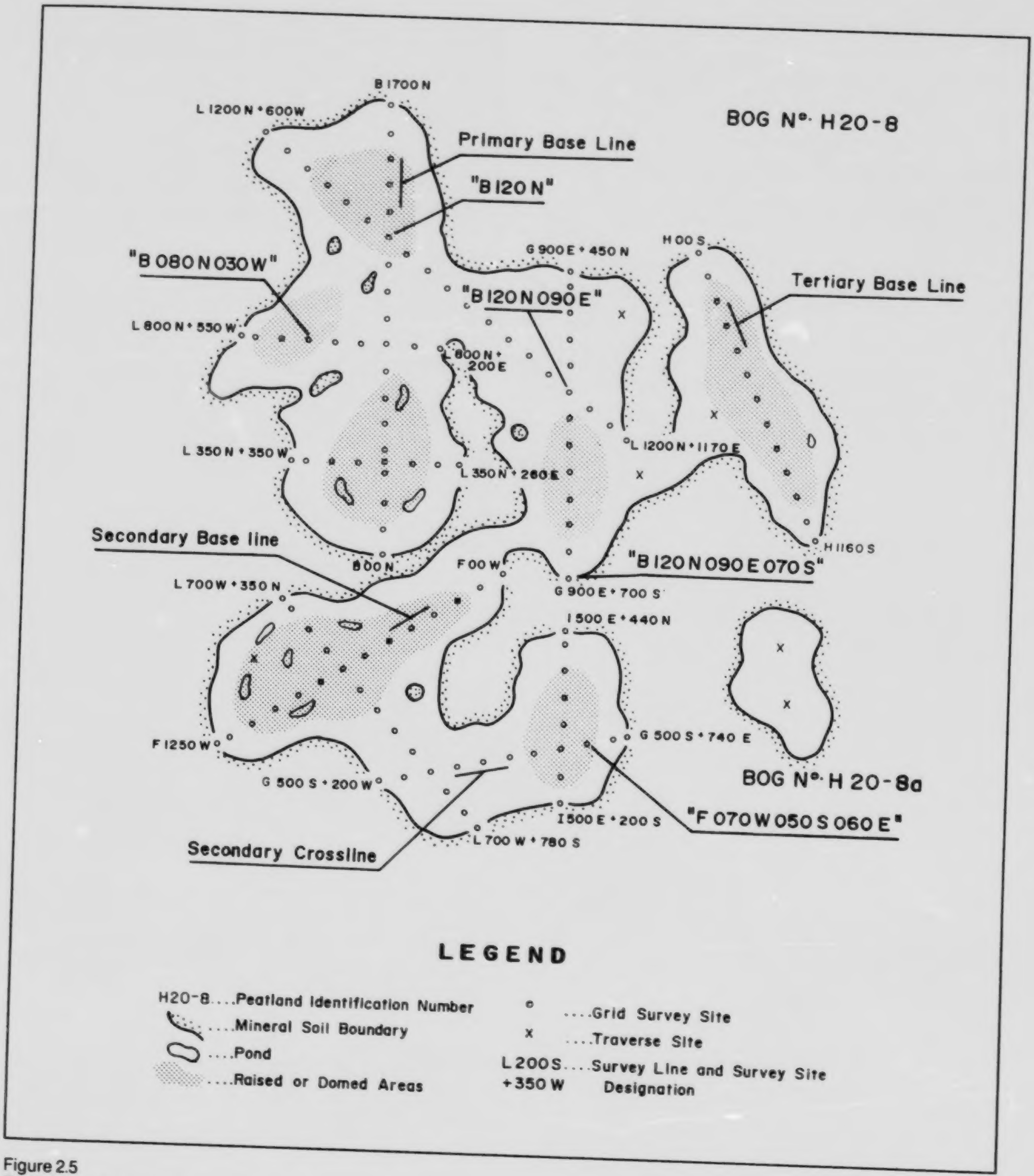
BOG N°· H20-8
BOG N°· H 20-8a
B 1700 N
L 1200 N + 600 W
Primary Base Line
"B 120 N"
"B 080 N 030 W"
G 900 E + 450 N
H 00 S
Tertiary Base Line
"B 120 N 090 E"
L 800 N + 550 W
L 800 N + 200 E
L 350 N + 350 W
L 1200 N + 1170 E
L 350 N + 260 E
Secondary Base line
B 00 N
F 00 W
"B 120 N 090 E 070 S"
H 1160 S
L 700 W + 350 N
G 900 E + 700 S
I 500 E + 440 N
F 1250 W
G 500 S + 740 E
G 500 S + 200 W
I 500 E + 200 S
"F 070 W 050 S 060 E"
L 700 W + 780 S
Secondary Crossline
LEGEND
H20-8....Peatland Identification Number
....Mineral Soil Boundary
....Pond
....Raised or Domed Areas
....Grid Survey Site
....Traverse Site
L 200 S
+350 W
....Survey Line and Survey Site Designation

Figure 2.5
Grid system placement and numeration.

Surface Elevation Survey
Once a grid system of survey sites was established on the peatland, levelling crews determined elevations for all the sampling sites except traverse points. To reduce errors in levelling resulting from heat waves and unstable bog surfaces, the entire grid was usually broken into a series of small loops, tied to control bases (pegs) at the intersections and ends of survey lines. Closing errors for these small loops could be kept to less than 10 cm and the entire grid was required to close within 30 cm.

Topographic elevations for deposits were determined by using nearby survey control monuments where available. In areas where access was poor, elevations were established using single and double based barometric levelling procedures or using contours from (1:10 000) orthophoto maps.

Site Description
At each site peat cores were retrieved at 1.5 foot (50 cm) depth intervals using a Hiller auger (Figure 2.6). From the surface to mineral soil contact, samples were analyzed in 4 inch (10 cm) intervals.

A total of 15 parameters associated with the samples were determined and coded on computer formatted field cards for later key punching and processing. These parameters included:

- a location code comprised of the deposit and survey site numbers
- Radforth growth forms (Appendix I)
- snags or stumps embedded in the peat layer
- Jeglum surface cover types (Appendix I)
- micro relief elements
- site remark codes (Appendix I), and
- bottom sediment.

For each peat lense the following parameters were determined: depth, botanical composition, humification, relative moisture level, fine and coarse fibre content, woody remnants, and other incidental features.

The classification procedure used at each site and the associated abbreviation lists and classification tables, are presented in Appendix I "Field Sample Analysis Procedure".

All of the above, with the exception of Jeglum surface cover types and micro relief elements, are described fully by Keys and Henderson (1983).

Jeglum Surface Covertypes
The codes representative of peatlands as proposed by Jeglum *et al* (1974), directly reflect the ecology of the peatland surface. The covertypes are easily interpreted on large scale photographs, providing a detailed listing of vegetation on the surface of the peatland. The interpretation and mapping of these covertypes in this study has led to a greater understanding of the peatland environment, and should provide information useful both for surface preparation in peatland development and as a permanent ecological record of the peatland. A detailed description of the Jeglum types commonly found in peatlands is presented in Appendix II.

Figure 2.6
Sampling augers. A. Hiller auger. B. MacAulay sampler.

Micro-Relief
The micro-relief of the surface of the deposit is simply a description of relative hummock sizes. It is recorded as a rise and a run element, which are the approximate average height and width in decimeters of the hummocks present at each site. These values are recorded as part of the ecological record for the deposits.

Site Remarks
Special remarks describing the surface of the bog at each site were recorded in a coded form in a "site remarks" section on the field cards. A coding system, which was developed for this inventory, is meant both to provide more detail and to provide standardization of this data.

A system of two letter abbreviations for surface vegetation species was used in the present study. These codes were recorded in order of dominance for each species, and in the same order in which each of the Radforth growth forms were recorded for the site. A more detailed description of the procedure is provided in Appendix I.

Peat Classification
All peat cores retrieved at each site were first broken into sections corresponding to intervals based on general similarity of botanical composition and apparent degree of humification of the peat.

Each interval was then examined in detail to determine degree of humification and composition of the peat. First, all free water was removed from the sample by gently squeezing it a number of times, taking care to minimize disturbance to the sample. Then a formal "squeeze" test was performed, and the relative humification of the sample estimated using the von Post scale (Table 2.1). The relative plant composition of the sample was then determined. This usually meant determining major plant components of the peat such as *Sphagnum* (sphagnum-based peat) or *Carex* (sedge-based peat), and then noting other common constituents such as *Eriophorum*, shrubs, or wood.

Humification Scale	Evidence of Degree of Decomposition	Plant Structure	Upon squeezing Through Fingers			
			Mud Present	Water Passing	Amount of Peat Substance Passing	Residue
1	Nil	—	Nil	Yes. Clear and colourless	—	—
2	Almost nil	—	Nil	Yes. Clear but yellow brown	—	—
3	Very little	—	Little	Yes. Distinctly turbid, very turbid	—	Not pulpy
4	Little	—	Some	Very turbid	—	Somwhat pulpy
5	Fairly evident	Barely recognizable	Moderate	Moderate amount	Some	Very pulpy
6	Fairly evident residue	Indistinct	—	—	One-third	Very pulpy, shows plant structure more than unsqueezed turf
7	Strong	Fairly recognizable	Much	Yes, gruelly and dark in colour	One-half	—
8	Strong	Very distinct	Much	Yes or no. If it does, gruelly	One-half	Consists of more resistant roots, fibres etc. in main
9	Almost fully decomposed	Almost unrecognizable	Very much	—	Almost all as a uniform paste	—
10	Completely decomposed	Entirely without plant structure	Entirely muddy	No free water	All	—

Table 2.1
Method for determination of humification of raw peat samples
(Geological Survey of Finland)
(From von Post 1926)

Less common constituents, such as *Scirpus* sp. (Tr), *Scheuchzeria* sp. (Sh) and *Phragmites* sp.(Pr), were recorded separately. The relative composition of the plant remains making up the peat was estimated to the nearest 10 percent for each constituent. The presence of other minor components such as charcoal, sand, and plant seeds, was recorded in the remarks for each interval.

Identification of plant remains in poorly decomposed peats is relatively simple, but becomes more difficult as the degree of humification of the peat increases. Field personnel in many instances made subjective assessments of plant remains making up the peat from the "look and feel" of different types of peat at various degrees of decomposition. Factors such as color, texture, and presence of constituents such as fern rootlets and wood splinters, which are more tolerant to decomposition, were used for determination of relative composition of highly humified peats.

Other parameters, such as content of fine fiber, coarse fiber, wood content, and the degree of wetness of the peat, were recorded separately. These gave a quick indication of some mechanical attributes of the peat which may be a hinderance to possible commercial development. More information on these parameters is contained in Appendix I.

2.2.3 Data Analysis

Data analysis consisted of computer processing and interpretative processing. Computer processing refers to all mathematical work carried out on the raw inventory data by computer, and interpretive processing refers to analysis which involved some level of human interpretation.

Computer Processing

All data gathered in the field was recorded on computer formated cards and entered onto magnetic tape as raw data files for each deposit. Data files were then checked and edited with the help of error scanning programs. Processing of the edited data through a main calculation program then generated summary reports for each survey site within a deposit and for the deposit as a whole.

Virtually all computer analyses were carried out on data from sample sites where peat deposits were thicker than three feet (1m). Generally the number of sites having deposits less than one meter in thickness were quite small, and any data derived from those sites would not be truly representative. Where deposits were less than three feet (1m) in thickness, we used an assumed average thickness of 1.6 feet (0.5 meters).

To simplify analysis, the data was broken down into categories corresponding to surficial deposits (humificatons of H_1 to H_4), humified deposits (humifications of H_5 to H_{10}), and overall data (humifications of H_1 to H_{10}). In addition the software provided percentage of peat types and degree of humification in various depth ranges in relation to the surface of the deposit.

The following is a brief list of the types of information provided as a result of computer processing:

- average thickness, and humification of the deposit
- average humification of 22 peat types
- percentage contribution and volume of 22 peat types
- percentage composition and volume of 3 dominant peat groups (*Sphagnum* (S), *Carex* (C), and *Bryales* (B) based peats)
- percentage composition and volume of layers where minor peat types (shrubs (N), *Eriophorum* (Er), *Scirpus* (Tr), etc) exceed 10 percent
- percentage contribution and volume of peat in each humification class, and
- percentage of surface covered by various Jeglum cover types.

Computer processing also provided a variety of general descriptive data such as bog name, latitude and longitude, surface area, county, location and access, and drainage. In addition it generated resource reports at a regional level with a "regional report writing program". This program summarizes groups of deposits which satisfy any number of specific criteria. The program permitted consideration of in excess of 600 variables, in various combinations, to extract and process a number of deposits. For example, a regional report might be created for all peatlands in the province having greater than 250 acres (100 hectares) in total area with more than three feet (1m) of humified peat. Deposits meeting these criteria may be considered of interest for fuel peat industries.

Computer processing also generated graphic cross sections of the peat deposits along survey lines in the form of plotted sections or profile shells. All base information required for interpretation and drafting of possible peat layers is contained in the profile shell, although interpretation of this base or shell of data, and final drafting, must still be done by hand. These profiles were often used in assessing the viability of inventoried deposits for commercial development.

Interpretive Processing

Interpretive processing is concerned with manipulations of inventory data which require some aspects of human interpretation. These processes include the creation of peatland surface covertype maps, peat isopach (relative thickness) maps, peat elevation maps, and peatland profiles.

The surface covertype map of the deposit was prepared by placing survey point locations on aerial photographs using site location sketches and other data recorded at each site during field surveys. Care was taken to ensure that recorded line point distances and surface covertypes observed in the field agree with the grid pattern on the photographs. The task of delineating the deposit margin and mapping variations in vegetation was then completed on the "stereo" image. Information recorded on the photographs was transferred to a suitable map using a "best fit" process to overcome any apparent geometric distortions. Due to the limited relief exhibited by peatland areas, no major distortions in peatland boundaries were encountered.

Initially, 1:15,840 black and white and color photographs, in conjunction with 1:15,840 forest series maps, were used to map the deposits. Later in the program, 1:10,000 orthophoto maps became available and interpretation was carried out using 1:10 000 color photography, resulting in improvements in mapping speed and accuracy.

Isopach and elevation maps were prepared using base information from the surface covertype maps generated as described above. All relevant peat thickness and surface elevation data were then plotted on separate maps. Examples of isopach, elevation, and covertype maps are presented in Figures 2.7, 2.8 and 2.9 respectively. Subsequently a "stereo image" of the deposit was viewed to determine the general shape and slope of domed or raised areas of bogs, and to infer the location of maximum peat thickness. This information was then used to interpret accurate peat thickness and surface elevation contours for each deposit from the survey point data.

Another form of interpretive processing was the determination of peatland cross sectional profiles. Profiles must be interpreted to outline the various major and minor lenses of peat in the deposit. Separate profiles were created for different peat types and degrees of humification in the deposit (Figure 2.10).

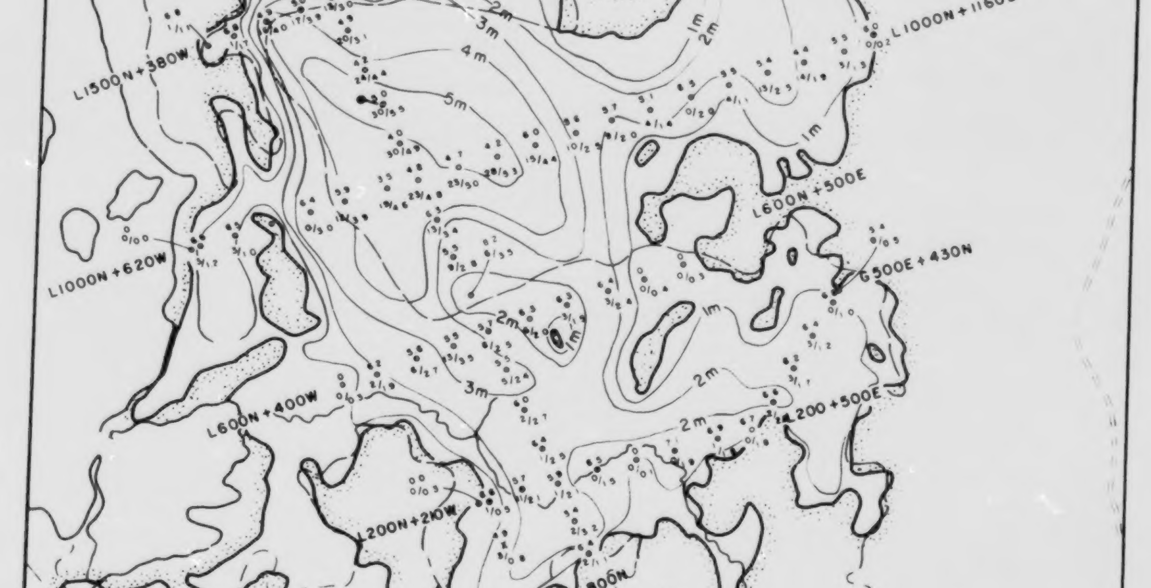
B1820N
L1500N + 390E
L1000N + 1160E
L1500N + 380W
L600N + 500E
L1000N + 620W
G300E + 430N
L600N + 400W
L200 + 500E
L200N + 210W
800N
Crown Boundary 279' Contour
Crown Bo
279' C
1m
2m
3m
4m
5m
6285
6284
6286
6283

Figure 2.7
Detail of peat isopach map (P11-5).

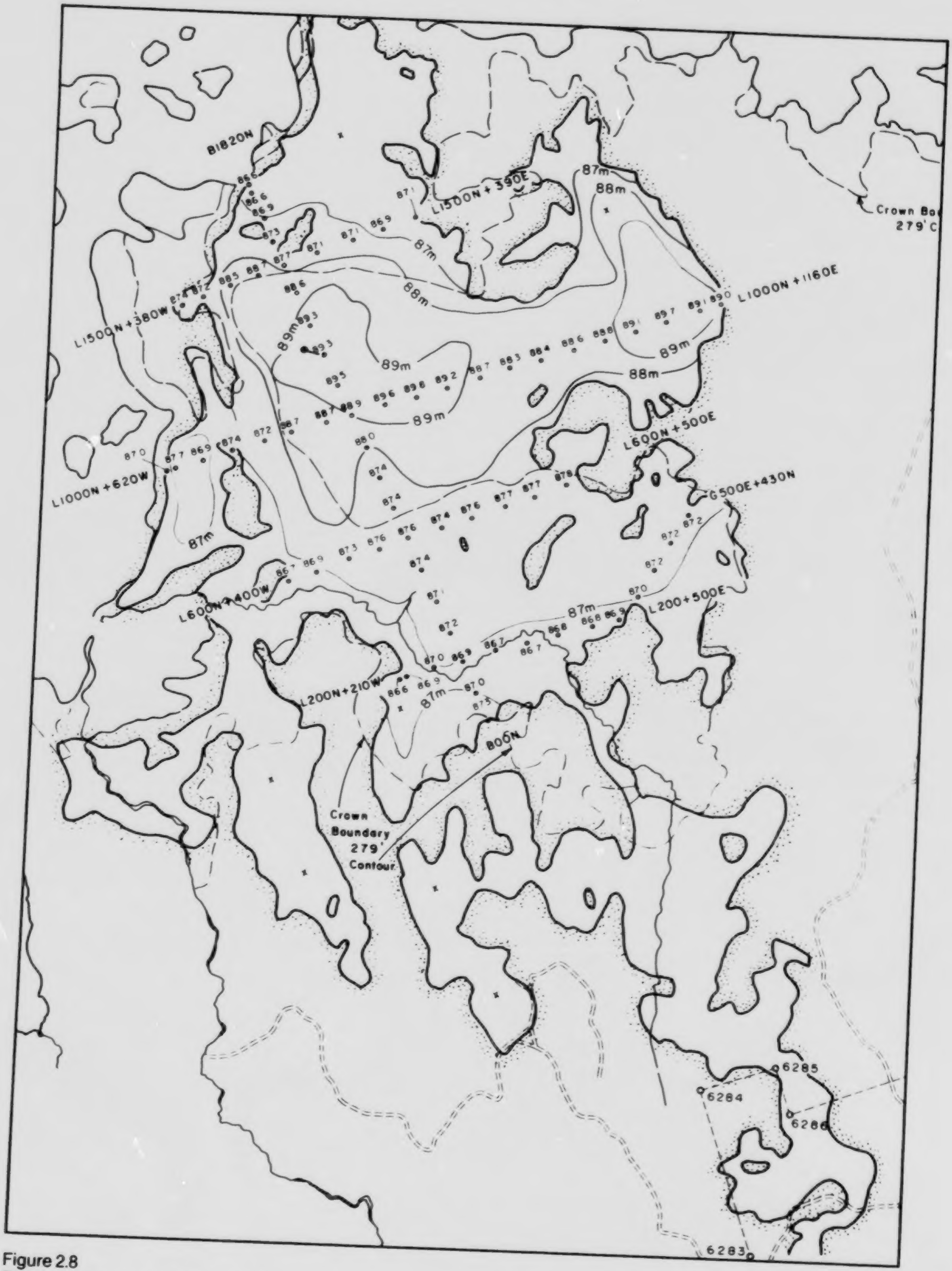
B1820N
L1500N + 390E
87m
88m
Crown Bo
279'C
L1000N + 1160E
L1500N + 380W
89m
89m
89m
88m
88m
87m
L1000N + 620W
L600N + 500E
G500E + 430N
87m
L600N + 400W
87m
L200 + 500E
L200N + 210W
87m
800N
Crown
Boundary
279
Contour
6285
6284
6286
6283

Figure 2.8
Detail of a surface elevation map (P11-5).

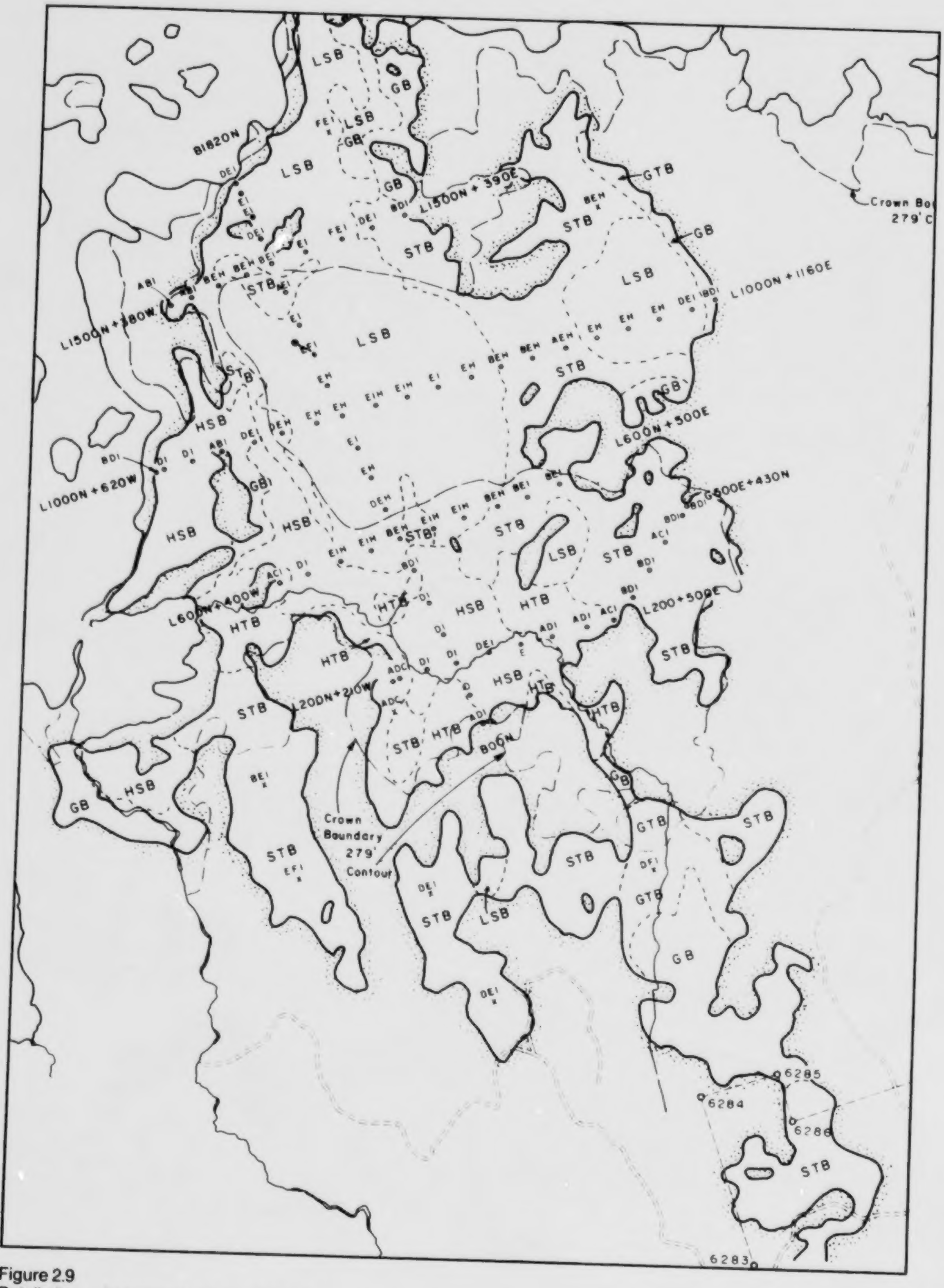
LSB
GB
STB
HSB
HTB
GTB
81620N
L1500N + 390E
L1000N + 1160E
L1500N + 380W
L1000N + 620W
L600N + 500E
G600E + 430N
L600N + 400W
L200 + 500E
L200N + 210W
800N
Crown Boundary 279' Contour
Crown Bo 279' C
6285
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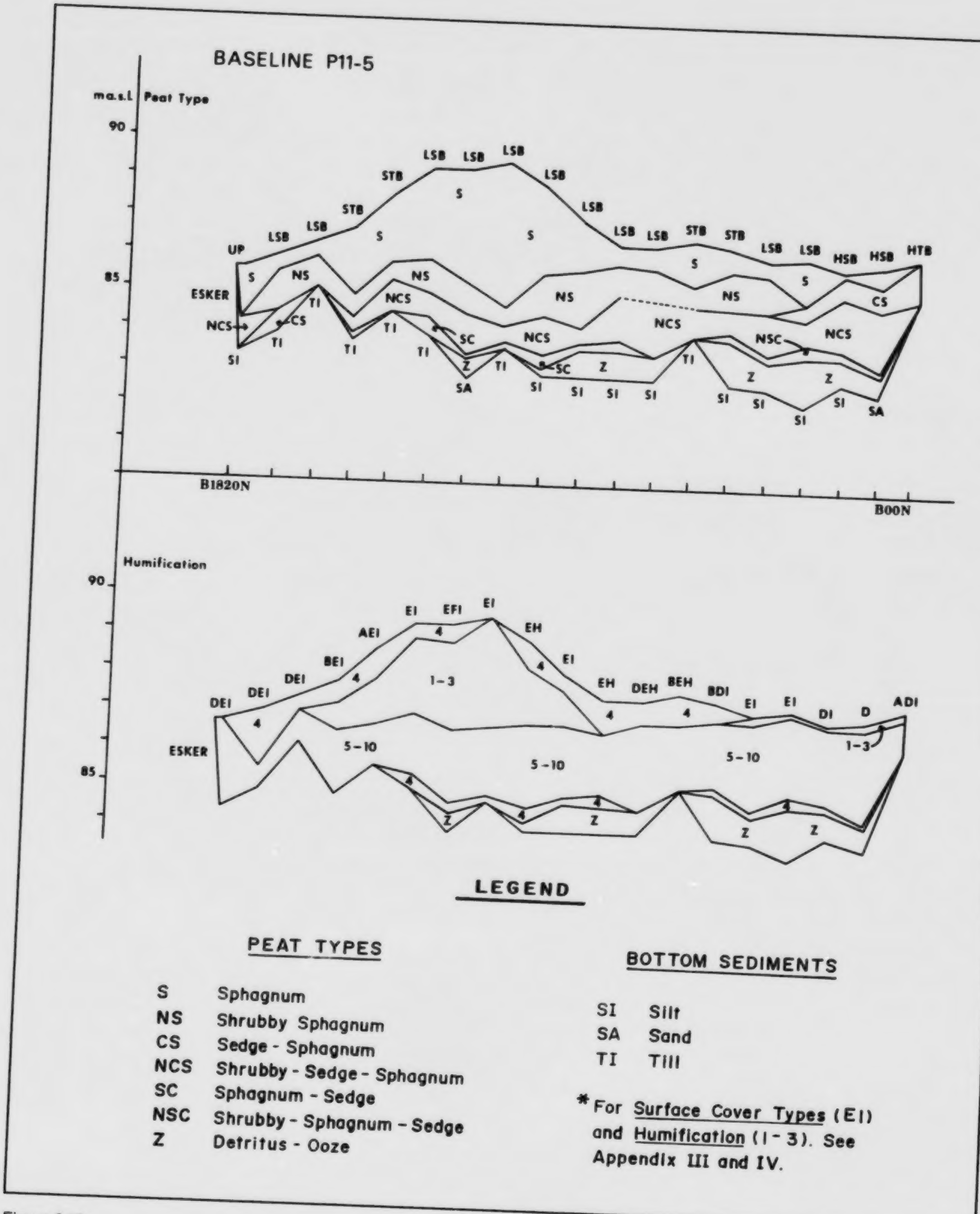
Figure 2.9
Detail of a surface covertype map (P11-5).


BASELINE P11-5
m a.s.l.
Peat Type
90
85
UP
LSB
LSB
STB
STB
LSB
LSB
LSB
LSB
LSB
LSB
LSB
STB
STB
LSB
LSB
HSB
HSB
HTB
S
S
S
S
S
S
ESKER
NS
NS
NS
NS
NCS
NCS
NCS
NCS
NCS
NCS→
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SI
SI
SI
SI
SI
SA
B1820N
B00N
Humification
90
85
DEI
DEI
DEI
BEI
AEI
EI
EFI
EI
EH
EI
EH
DEH
BEH
BDI
EI
EI
DI
D
ADI
ESKER
4
4
4
4
4
4
4
4
4
4
1-3
1-3
5-10
5-10
5-10
Z
Z
Z
Z
LEGEND
PEAT TYPES
S Sphagnum
NS Shrubby Sphagnum
CS Sedge - Sphagnum
NCS Shrubby - Sedge - Sphagnum
SC Sphagnum - Sedge
NSC Shrubby - Sphagnum - Sedge
Z Detritus - Ooze
BOTTOM SEDIMENTS
SI Silt
SA Sand
TI Till
* For Surface Cover Types (EI) and Humification (1 - 3). See Appendix III and IV.

Figure 2.10
Peatland profiles for deposit P11-5.

2.2.4 Resource Information Provided

A large volume of resource data has been gathered by this inventory program. The bulk of the data has been obtained using classification criteria of a qualitative nature, which could be used to gather data quickly from deposits representative of the various regions surveyed. Information gathered from specific deposits was then extrapolated to provide an estimate of the peat resource in each region and subsequently for the whole province.

Raw data and resource summaries are available through the Department of Mines and Energy in three forms.

1) raw inventory data listings and summaries for each deposit
2) regional and provincial resource summaries of all deposits
3) potential harvestable reserves

"Resource" and "Potentially Havestable Reserve" values presented in this report are based strictly on volume calculations relative to the total surface area of the deposit and areas interpreted to be greater than 3 feet (1M) in depth.

While "Resource" values provide an excellent general categorization of the resource, in recognition of the fact that other parameters are involved in determining if a peat resource is exploitable, estimates of "Potentially Harvestable Reserves" in some kay areas of the province are also discussed later in section 3.1.4. These values have been based upon the following set of loosely defined parameters:

a) over 3 feet (1m) of harvestable peat
b) less than 1.5 feet (50 cm) of strippable overburden
c) individual or cumulative havestable area in excess of 250 acres (100 ha), and
d) minimum of tree cover, suitable drainage and access

Tonnage estimates of "Harvestable" reserves are calculated using industry standards developed in current peat production areas (Monenco Ontario 1981).

2.2.5 Data Reliability

The types of errors in raw inventory data and in the methods of calculating basic resource estimates, are common to most regional resource surveys of this kind. Although they should not be ignored, they also do not detract from the value of the peatland data base which has been created by this program.

As the Peatlands Inventory Program focussed mainly at providing an overview of potential peat resources, estimates for individual peatlands are not as precise as would be required to determine if the deposits could be developed commercially. It is therefore strongly recommended that a detailed resource and reserve delineation study be carried out on each deposit considered, before commercial development.

2.3 The Nova Scotia Peat Resource

The bulk of Nova Scotia's peatland resource occurs in the small number of regions inventoried in this study. The major regions are Southwestern Nova Scotia, Hants, Cumberland, and Guysborough counties, and Cape Breton Island (Figure 2.11), but some deposits of importance occur in Halifax, Kings, and Pictou counties.

General characteristics of the peat resources and inventory effort in each of these regions are discussed in the following section, while a detailed consideration of the peat resource of each is contained in subsequent sections. In the latter assessment, only the major peat deposits, those that have potential for peat moss, fuel peat, or as conservation sites, have been discussed in detail. These deposits have been flagged according to the following criteria:

— Horticultural Moss Peat Deposits. All deposits having greater than 125 acres (50 ha) in excess of 3 feet (1 m) in thickness, and having an average of greater than 6 feet (2 m) of unhumified or moss grade peat.

— Fuel Peat Deposits. All deposits having more than 125 acres (50 ha) of surface area in excess of 3 feet (1 m) thickness, where there is on average less than 3 feet (1 m) of surficial or moss grade peat, and an average of more than 6 feet (2 m) of humified or fuel grade peat.

— Conservation sites. Deposits which are worthy of preservation as conservation sites as a result of hydrology, presence of rare or endangered fauna or flora, or due to uniqueness of the peatland type.

A total of fifty-two deposits of major significance have been extracted from our provincial peatland data base, and will be discussed in the following sections.

2.3.1 Regional Distribution of Peat Resources and Survey Effort

Nova Scotia Summary

Summaries of inventory efforts and resource estimates by county and for the province as a whole, are contained in Tables 2.2 and 2.3. Peatlands in the province are on average 9.2 feet (2.8 m) in thickness, and contain 52 percent of fuel grade peat. These values have been derived from a total of 81,757 acres (33 087 ha) of peatland surveyed, or roughly 22 percent of the provincial resources. This area contains 267 surveyed deposits (Table 2.2), inventoried using 7 604 survey points. A total of 55,354 feet (16 872m) of peat core were drilled and classified over five seasons of peatland investigations.

Southwestern Nova Scotia

Yarmouth, Shelburne, and Queens Counties make up the Southwestern Nova Scotia region and were the first area to be investigated in this study. An inventory of this region began in the spring of 1980 and extended over three field seasons, ending in the fall of 1982.

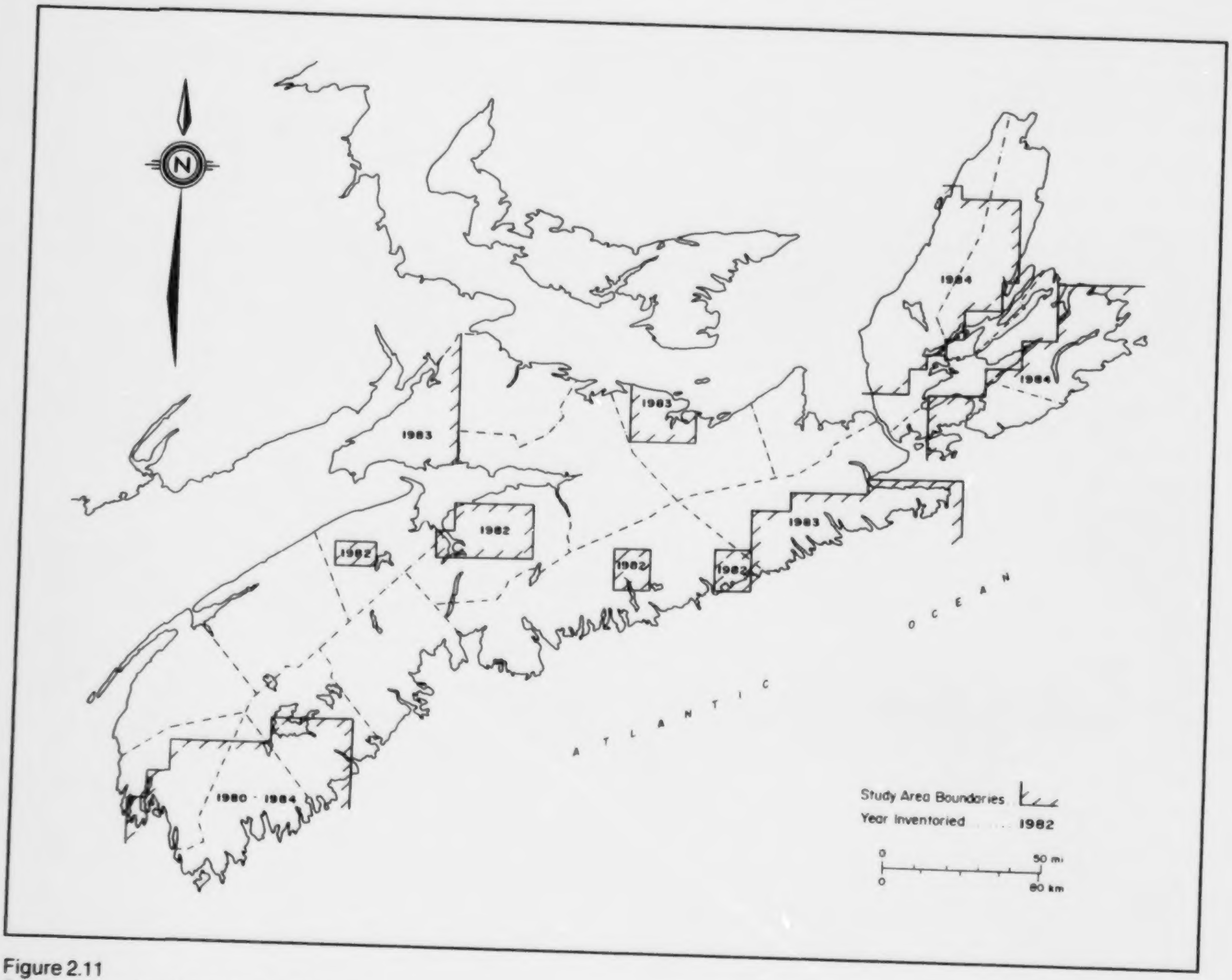

Figure 2.11
Peatland Inventory Program study areas.

Yarmouth County
A total of thirteen deposits were studied in Yarmouth County using some 656 inventory points. Roughly 25 percent of the county's 24,322 acres (9 843 ha) of peatland were surveyed. Average thickness of deposit was 7.9 feet (2.4 m). Fuel grade peats comprise about 63 percent of the 4,630 feet (1 411 m) of peat core classified in this area (Table 2.2).

Shelburne County
Approximately 25 percent of the total peatland surface area in this county was investigated. Forty-five separate deposits were surveyed and average thickness was 7.5 feet (2.3 m). A total of 1,974 survey points were studied, representing some 13,000 feet (3 962 m) of peat core. Sixty-five (65) percent of the peat core was of fuel grade.

Queens County
Roughly 32 percent of all inventory work was carried out in this area. In terms of total area surveyed this was equivalent to 60 percent of the county's resources. Some 9,410 feet (2 868 m) of peat core, extracted from the 1,395 sites investigated in the county, has shown that 63 percent of peatland deposits are fuel grade in composition. Queens County peatlands have the same average total depth as Shelburne County.

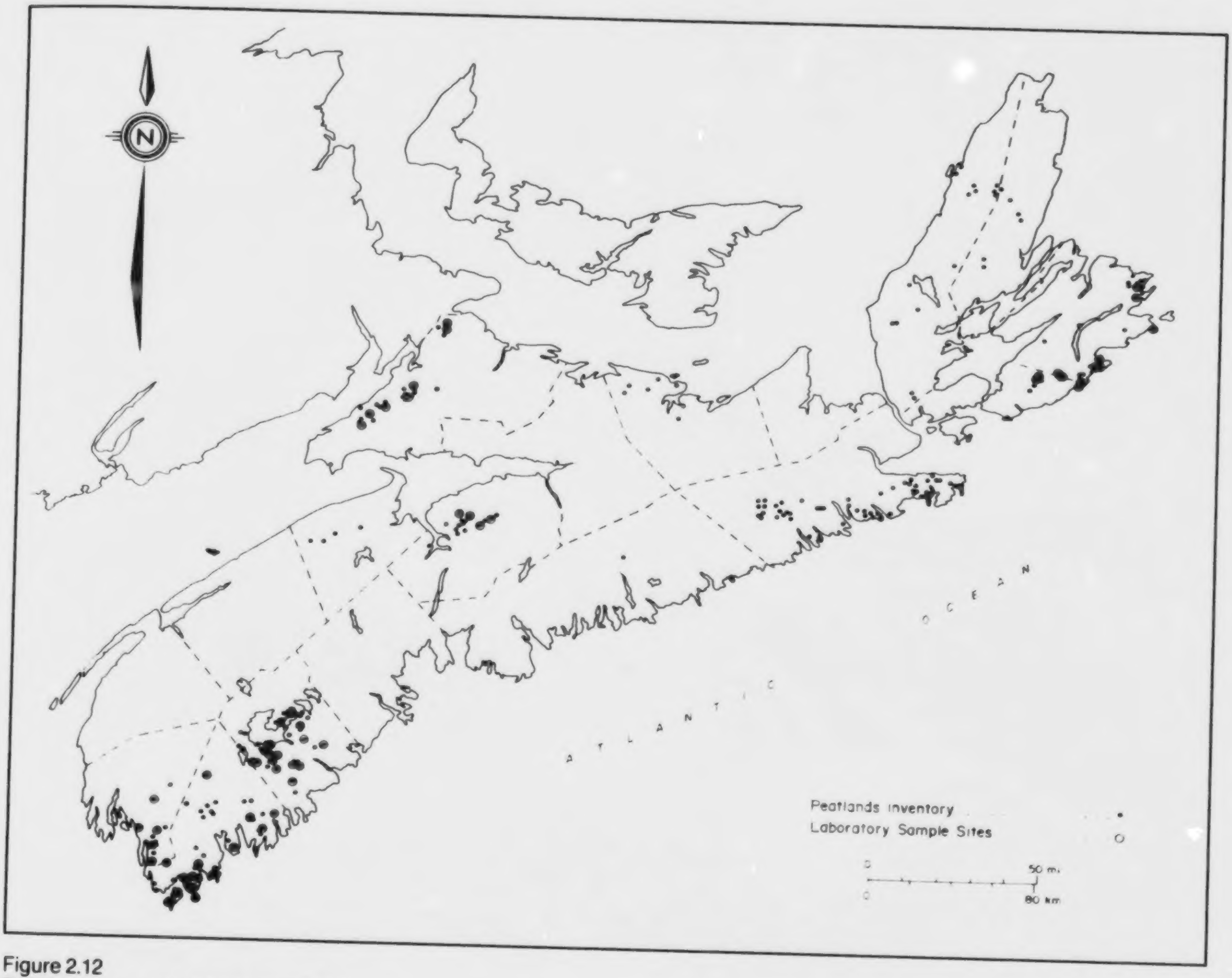

Figure 2.12
Peatland resources investigated, 1980-1985.

Hants County

The survey of the peatland resources of Hants County began in the spring of 1982 while work was still continuing in southwestern Nova Scotia. Roughly 5,634 acres (2 280 ha) of resource were investigated, an area equivalent to 39 percent of the county's total resources. The work has been carried out on 15 separate deposits, from which 5,760 feet (1 754 m) of peat core were evaluated at 469 survey points. Peat core studied in the region showed an average total thickness of 14.3 feet (4.5 m). However only 40 percent of the peat strata was fuel grade. The work was completed in the fall of 1982.

Cumberland County

An inventory of the peat resources of Cumberland County was completed during the summer of 1983. Twenty-five deposits, containing approximately 10,084 acres (4 081 ha) or 68 percent of Cumberland County's resources, were investigated. Peat core was extracted from 643 survey points. Average thickness of deposit was 4.9 feet (1.5 m), and composition was found to be of 46 percent fuel grade peat.

Study Area	Total Resources (Hectares)	% of Resource Investigated	Deposits Investigated	Points Classed	Cum. Depth (Decimeters)	Average Depth of Sampling Sites (M)	Fuel Peat (% of Total Volume)
Yarmouth	9 843	25	13	656	14 114	2.41	63
Shelburne	25 640	27	45	1 974	39 616	2.30	71
Queens	19 031	60	43	1 395	28 682	2.30	63
Digby	7 852	0	0	0	0	2.83*	52*
Annapolis	15 715	0	0	0	0	2.83*	52*
Kings	4 451	14	4	109	2 390	2.39	57
Lunenburg	8 835	0	0	0	0	2.83*	52*
Halifax	14 114	2	2	96	2 845	3.56	21
Cumberland	5 984	68	25	643	15 609	2.73	46
Colchester	1 993	0	0	0	0	2.83*	52*
Hants	5 851	39	15	469	17 357	4.46	40
Pictou	1 818	20	7	10	255	2.55	18
Guysborough	14 403	25	58	887	20 331	2.66	43
Antigonish	922	0	0	0	0	2.83*	52*
Victoria	3 184	13	5	173	2 712	1.86	10
Inverness	6 187	19	16	305	4 240	1.66	36
Cape Breton	10 108	24	27	656	15 466	2.87	24
Richmond	5 879	11	7	231	4 829	2.57	20
Totals	161 810	20	267	7 604	168 726	2.83	52

*based on regional average depths

Table 2.2
Summary of inventory efforts and resource estimates by county, Nova scotia Peatlands Inventory Program, 1980-85.

Study Area	Points Investigated	Area ≥ 1M hectare	Average Depth ≥ 1M (m)		Average Hum. ≥ 1M		Volume ≥ 1M (Mm^3)		Million Tonnes ≥ 1M*		% Fuel Grade (tonnes)	Million[1] Bale Eq. Peat Moss Surficial	Million[2] Barrels Eq. Light Oil
			Surficial	Humified	Surficial	Humified	Surficial	Humified	Surficial	Humidified			
Southwestern N.S.													
Inland	292	825	0.90	1.55	3.2	6.2	8.51	12.70	1.24	2.41	66	5.53	4.22
Coastal	2 146	3 914	0.97	1.61	3.3	6.2	39.67	63.35	5.79	12.04	68	119.01	21.07
Lake Rossignol	1 587	4 786	1.11	1.51	3.3	6.1	54.56	71.21	7.97	13.53	63	163.68	23.68
Hants County	469	1 490	3.04	1.53	3.2	5.1	44.27	23.38	6.46	4.44	41	132.81	7.77
Cumberland County	643	2 065	1.76	1.15	3.0	5.8	35.29	18.52	5.15	3.52	41	105.87	6.16
Guysborough County	887	1 979	1.80	1.03	3.1	4.1	36.66	20.72	5.35	3.94	42	109.98	6.90
Cape Breton													
Lowland	1 038	1 906	2.24	0.62	3.1	5.2	45.88	11.96	6.70	2.27	25	137.64	3.97
Highland	327	550	1.83	0.14	3.0	4.4	10.15	0.81	1.48	0.15	9	30.45	0.26
Other													
Kings	109	346	1.30	1.34	3.3	5.5	4.53	4.71	0.66	0.89	57	13.59	1.56
Pictou	10	182	2.17	0.38	3.4	4.8	3.60	0.49	0.53	0.09	15	10.80	0.16
Halifax	96	194	2.98	0.61	3.1	5.6	5.91	1.12	0.86	0.21	20	17.73	0.37
Totals	7 604	18 237	1.55	1.28	3.2	5.6	289.00	229.00	42.00	43.00	52	867.00	76.00

Values are given for areas where peat depths exceeds 3 ft (1m).
*tonnes at 50% moisture content calculated using
— surficial peats H1-4 equals 0.146 tonne per in situ M
— humified peats H5-10 equals 0.190 tonne per in situ M
abridged: Montreal Engineering Co. Ltd. (1980)

[1] one m^3 in situ = three 6 cu. ft. (170 l) bales at 75% recovery
[2] barrels = tonnes at 50% M.C. × 1.75 barrels No.2 oil/tonne

Table 2.3
Regional resource summary

Guysborough County
Investigations of the resources in Guysborough County were also completed during the summer of 1983. A total of 6,670 feet (2 033 m) of peat core were classified, utilizing some 887 survey points on fifty-eight separate peatlands. These deposits represented roughly 8,865 acres (3 515 ha) of peatland, or about 25 percent of the county's total resource area. Deposits in the region were usually quite small and in many cases were arranged in clusters which were inventoried as a group. Peat layers were found to be on average 3.9 feet (2.7 m) thick and roughly 18 percent fuel grade in composition.

Cape Breton Island
The resources of the four counties of Cape Breton Island were inventoried during the last field season of the program. Work in Cape Breton County and Richmond County involved a survey of thirty-four deposits. The twenty-seven deposits located in Cape Breton County were surveyed using 656 inventory points, from which approximately 5,075 feet (1 547 m) of peat core were analyzed. Average thickness for Cape Breton County was 9.5 feet (2.9 m). Only 24 percent was fuel grade. Roughly 1,584 feet (483 m) of fuel grade peat from 231 survey sites were evaluated in Richmond County. Relative amounts of fuel grade peat determined from seven deposits in this area were virtually the same as those in Cape Breton County. The resources surveyed in Cape Breton and Richmond counties represent only 10 percent of their total resources.

Peatlands inventoried in Victoria and Inverness counties comprised 19 and 25 percent of their respective total resource areas. Five deposits have been inventoried in Victoria County, representing some 173 survey sites and a total length of peat core of 889 feet (271 m). The average depth of deposit in the area was around 6.2 feet (1.9 m), and only 10 percent of the peat classified was fuel grade. In Inverness County, 16 deposits were studied and found to contain 36 percent fuel grade peats. The average depth of peat in the County of 5.6 feet (1.7 m) has been determined from 305 survey points, from which 1,391 feet (424 m) of peat core was analyzed.

Other areas
Some resources were investigated in Kings, Halifax, and Pictou counties. Average thicknesses of the peat deposits were 7.9, 7.8, and 8.5 feet (2.4, 2.3, and 2.6 m) respectively. A summary of efforts in these areas is presented in Table 2.2.

Resources in Annapolis, Digby, Lunenburg, Colchester, and Antigonish counties have not been investigated, and are assumed for our purposes to have thicknesses and fuel grade compositions equivalent to the provincial averages.

2.3.2 Peat Resources of Southwestern Nova Scotia

Regional Environmental Setting and Peatland Development

Physiography
Southwestern Nova Scotia, as defined in this report, consists of the three counties of Yarmouth, Shelburne, and Queens (Figure 2.13). Geologically the region consists primarily of eroded metamorphic greywacke and schists, which create a low lying, gently undulating topography of low, parallel, ridges and valleys. For the most part tills have developed locally by glacial action, and the resulting soils tend to be variable but generally coarse textured. Extensive forest fires in the region have severely damaged much of the forest soils, removing the organics, creating fluctuating water tables, and forming an impermeable soil layer which has influenced expansion and growth of many of the peatlands in the region (Cann and Hilchey 1959; Hilchey *et al* 1960; MacDougall *et al* 1961; Stea and Grant 1982; Stea 1982).

The coastal region of southwestern Nova Scotia, an area roughly 6-8 miles (10 km) wide along the Atlantic Coast, consists primarily of granitic terrain with relatively low, shapeless, ridges and depressions, covered with a thin layer of tills and numerous scattered large boulders. Soils in this region tend to be less sandy and gravelly than those in the interior.

These relatively poorly drained soils and fairly shallow topography have provided a number of water logged depressions, throughout the region, which are often occupied by extensive peatlands.

Climate
The local weather conditions of southwestern Nova Scotia vary substantially from one area to the next. Coastal regions may often be blanketed in fog, while regions a few kilometres inland experience warm sunny weather. However, in general, this region enjoys a cool temperate climate influenced a great deal by the Atlantic Ocean. The frost free period often lasts from early May until late October, a full 30 days longer than some other regions of Nova Scotia and the rest of Atlantic Canada. The climate of this region is quite conducive to peatland development and harvesting.

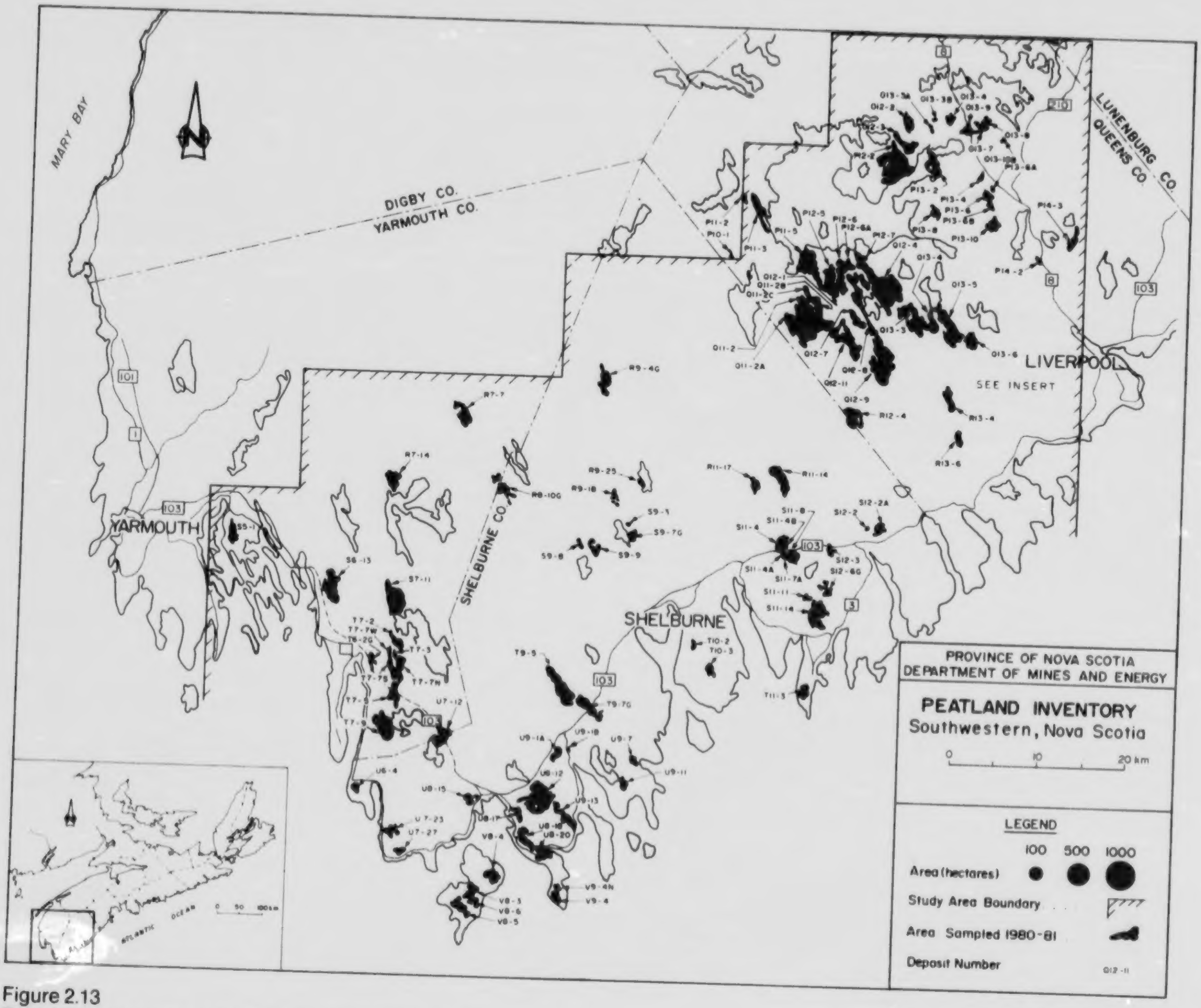
PROVINCE OF NOVA SCOTIA
DEPARTMENT OF MINES AND ENERGY
PEATLAND INVENTORY
Southwestern, Nova Scotia
0
10
20 km
LEGEND
100
500
1000
Area (hectares)
Study Area Boundary
Area Sampled 1980-81
Deposit Number
Q12-11
MARY BAY
DIGBY CO.
YARMOUTH CO.
SHELBURNE CO.
LUNENBURG CO.
QUEENS CO.
YARMOUTH
SHELBURNE
LIVERPOOL
SEE INSERT
ATLANTIC OCEAN
101
103
210
8
3
1

Figure 2.13
Peat deposits inventoried in Southwestern Nova Scotia.

Peatland Development

The extensive peatlands of southwestern Nova Scotia have developed gradually in low lying areas where water has accumulated, and along the edges of former lakes and ponds. Large swamps also exist at the margins of peatland, and represent the initial stages by which many bogs in this region expand horizontally and coalesce with neighbouring deposits to form extensive peatlands.

Domed and flat bogs cover the terrain in many coastal areas. There are also notable numbers of Atlantic Plateau deposits with large "Scirpus lawns" covering their surface. Sloping and basin deposits have also been inventoried.

Inland deposits, mainly in the lake Rossignol area, are large domed bogs and smaller flat bogs and basin deposits. Shore bogs and "Peat Margin" Swamps have also been surveyed in this area. Deposits of other inland areas are primarily basin bogs with some domed and flat deposits, and are much smaller in size.

Peatland Vegetation

The surface cover of peatlands in Nova Scotia may vary substantially depending on the ecology, topography, and drainage character of each deposit.

During the course of the survey program in southwestern Nova Scotia, some general trends or differences in cover character were noted between the "coastal" and inland (Lake Rossignol) peatlands. Generally, open peatlands throughout the entire region were dominated by low ericaceous shrubs. However there were considerably more instances of graminoid bog, in particular "*Scirpus* lawns", on the coastal deposits.

Inland deposits had a higher incidence of tree cover than coastal deposits. Roughly 33 percent of the surveyed resources that exceed 3 feet (1 m) in depth in the Lake Rossignol area were treed, while coastal zones were only 10 percent treed. This may be a factor accounting for the greater frequency of "basin" swamps and "peat margin" or "lagg" swamps in inland peat deposits.

Size and Distribution of Peatland Resource

Overview

A total of 47,720 acres (17 289 ha) or 32 percent of the peatland resource has been investigated in Southwestern Nova Scotia (Figure 2.13) (Table 2.4). Coastal resources studied represent 16,394 acres (6 635 ha). Of the combined area of inland and coastal resources, 23,535 acres (9 525 ha) of resource is greater than one metre in thickness.

Roughly 134.38 million cubic yards (102.74 Mm^3)* of surficial or moss grade peat have been estimated to occur in surveyed deposits.This could represent 310.22 million bales of peat moss. Fuel grade peats, associated with the humified layers of these deposits, represent nearly 192.61 million cubic yards (147.26 Mm^3) of resource. These volumes are equivalent to 16.53 million tons and 30.78 million tons (15.00 and 27.98 Mte) of in situ peat at 50 percent moisture content respectively (Table 2.3).

The occurrence of surficial or "moss" grade peat is fairly ubiquitous in Southwestern Nova Scotia. On average the thickness of this layer is 3 feet (1 m) or more, but maximum moss thickness may be as much as 12 feet (4 m). The peat is almost exclusively *Sphagnum* based with minor constituents of shrub and graminoid origin. The high frequency of "Scirpus lawns" in the coastal zone has caused a significant drop in the percentage of pure *Sphagnum* peat in the surficial layers, which may to some extent reduce the quality of peat moss that may be harvested in this region.

On average the humified layer was 5.5 feet (1.6 m) in thickness, with slightly thicker layers found in coastal deposits. In some deposits this layer was found to be 12-15 feet (3-4 m) in thickness. Average humification of the peat in this layer (average = $H_{6\cdot2}$) was quite high when compared with other regions of the Province. This would indicate a very good potential for the production of a high quality fuel grade peat.

Although the majority of the peat in the humified layer was *Sphagnum* based, the occurrence of minor constituents, such as shrubs and graminoids, was much higher than surficial peats. Most notably there was a higher frequency of *Carex* based peats, particularly near the mineral soil contact at the bottom of the deposit. However, it is anticipated that these minor elements would not affect the quality of fuel produced from the region.

Fuel grade peats inventoried could have the equivalent heat value of 48.49 million barrels of heating oil. A much greater percentage of the resource is fuel grade in southwestern Nova Scotia than in all other regions in the province. More than 63 percent of the overall resource is fuel grade peat. The percentage is higher in coastal peatlands.

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*Note: (Mm^3 = million cubic metres; Mte = million tonnes)

Study Area	Deposit Number	Points Investigated	Area (ha)	Average Depth (m)		Average Humification		Volume (Mm³)		Million Tonnes		Million Bale Eq. Peat Moss Surficial	Million Barrels Eq. Light Oil
				Surficial	Humified	Surficial	Humified	Surficial	Humified	Surficial	Humified		
Inland Zone	R0707	9	105	1.26	1.66	3.2	5.6	1.32	1.74	0.19	0.33	3.96	0.58
	R0714	70	100	0.35	1.96	3.8	6.3	0.35	1.96	0.05	0.37	1.05	0.65
	R0810G	5	49	1.00	1.58	3.2	6.0	0.49	0.77	0.07	0.15	1.47	0.26
	R0904G	70	143	0.45	1.68	3.5	6.8	0.64	2.40	0.09	0.46	1.92	0.81
	R0918	5	49	1.60	1.34	3.4	5.8	0.78	0.66	0.16	0.13	2.34	0.23
	S0907G	3	25	1.55	1.55	3.8	5.8	0.39	0.39	0.06	0.07	1.17	0.12
	S0909	4	32	1.45	1.88	2.7	5.3	0.46	0.60	0.07	0.11	1.38	0.19
	R1114	71	195	1.46	1.10	3.0	5.9	2.85	2.15	0.42	0.41	8.55	0.72
	R1117	45	70	1.27	1.36	3.4	6.0	0.89	0.95	0.13	0.18	2.67	0.32
	Others	8	57	0.59	1.91	3.4	6.0	0.34	1.08	0.05	0.21	1.02	0.37
Coastal Zone	T1002	41	73	1.12	2.24	3.4	5.7	0.82	1.64	0.12	0.31	2.46	0.54
	T1003	55	118	1.75	1.24	2.8	6.5	2.07	1.47	0.30	0.28	6.21	0.49
	T1103	39	106	1.52	1.31	3.1	6.0	1.61	1.39	0.24	0.26	4.83	0.46
	V0803	53	124	0.83	2.18	3.4	6.3	1.02	2.71	0.15	0.51	3.06	0.89
	V0804	50	55	0.57	1.14	2.8	7.3	0.31	0.63	0.05	0.12	0.93	0.21
	V0805	72	137	1.18	1.69	3.3	6.4	1.62	2.32	0.24	0.44	4.86	0.77
	V0806	17	41	0.25	1.56	2.8	6.7	0.10	0.64	0.01	0.12	0.30	0.21
	V0904	53	71	0.97	1.46	3.4	5.4	0.69	1.04	0.10	0.20	2.07	0.35
	U0604	32	32	1.49	1.54	3.3	6.2	0.48	0.49	0.07	0.09	1.44	0.16
	U0712	87	107	0.14	1.99	3.7	7.0	0.15	2.13	0.02	0.40	0.45	0.70
	U0723G	15	66	0.59	2.80	3.4	6.3	0.39	1.85	0.06	0.35	1.17	0.61
	U0727G	24	43	0.59	3.68	3.1	6.1	0.26	1.58	0.04	0.30	0.78	0.53
	U0812	196	349	0.55	1.93	3.6	6.2	1.92	6.74	0.28	1.28	5.76	2.24
	U0813	3	26	0.15	1.40	3.0	5.9	0.04	0.36	0.01	0.07	0.12	0.12
	U0817	4	58	1.03	2.40	2.8	5.8	0.59	1.39	0.09	0.26	1.77	0.46
	U0818	47	81	1.45	2.28	3.3	5.5	1.17	1.84	0.17	0.35	3.51	0.61
	U0820	79	106	0.96	1.52	3.0	6.3	1.02	1.62	0.15	0.31	3.06	0.51
	U0901	52	40	0.81	1.19	3.5	6.4	0.32	0.48	0.05	0.09	0.96	0.16
	U0911	28	32	0.57	.39	3.4	6.3	0.18	0.45	0.03	0.09	0.54	0.16
	U0913	111	163	0.57	1.55	3.1	6.7	0.92	2.53	0.13	0.48	2.76	0.84
	S0501	50	100	0.60	2.15	3.8	5.9	0.60	2.15	0.09	0.41	1.80	0.72
	S0613	98	208	1.34	1.38	3.3	6.7	2.79	2.87	0.41	0.55	8.37	0.96
	S0711G	95	298	1.77	1.01	3.4	5.8	5.28	3.01	0.77	0.57	15.84	1.00
	S1104G	49	47	0.86	0.76	3.5	5.9	0.40	0.36	0.06	0.07	1.20	0.12
	S1108G	37	45	0.98	1.93	3.5	6.0	0.44	0.87	0.06	0.17	1.32	0.30
	S1111	34	31	0.80	0.75	3.3	5.9	0.25	0.23	0.04	0.04	0.75	0.07
	S1114	79	150	1.91	1.22	3.2	5.9	2.87	1.83	0.42	0.35	8.61	0.61
	S1202G	10	66	0.09	1.77	3.6	7.0	0.06	1.17	0.01	0.22	0.18	0.39
	S1203	5	25	0.30	2.04	4.0	6.8	0.08	0.51	0.01	0.10	0.24	0.18
	S1206G	27	75	1.56	1.73	3.2	6.0	1.17	1.30	0.17	0.25	3.51	0.44
	T0602	10	57	0.90	1.29	3.1	5.3	0.51	0.74	0.07	0.14	1.53	0.25
	T0702	56	100	1.63	1.25	3.3	5.3	1.63	1.25	0.24	0.24	4.89	0.42
	T0703	4	18	0.43	1.45	3.2	5.4	0.08	0.26	0.01	0.05	0.24	0.09
	T0705	72	60	0.24	1.71	3.2	5.6	0.15	1.03	0.02	0.20	0.45	0.35
	T0707	43	50	1.33	0.89	3.4	5.5	0.66	0.45	0.10	0.09	1.98	0.16
	T0707N	28	71	1.02	1.26	3.3	5.7	0.72	0.90	0.11	0.17	2.16	0.30
	T0707W	7	22	0.60	1.59	3.1	5.1	0.13	0.35	0.02	0.07	0.39	0.12
	T0709	114	262	1.46	1.69	3.6	6.6	3.84	4.43	0.56	0.84	11.52	1.47
	T0905	114	222	0.72	1.43	3.4	5.8	1.59	3.16	0.23	0.60	4.77	1.05
	T0907G	81	126	0.45	1.90	3.5	6.0	0.56	2.40	0.08	0.46	1.68	0.81
	Others	75	53	0.32	1.47	3.3	6.6	0.18	0.78	0.03	0.15	0.54	0.26
Lake Rossignol Zone	R1204	3	75	0.57	1.03	3.1	5.8	0.43	0.78	0.06	0.15	1.29	0.26
	R1304	8	40	0.10	1.23	3.3	6.0	0.04	0.49	0.01	0.09	0.12	0.16
	R1306G	7	45	1.38	1.00	3.2	6.2	0.62	0.45	0.09	1.86	0.16	
	O1202	1	4	0.00	1.00	0.0	6.2	0.00	0.04	0.00	0.01	0.00	0.02
	O1203	10	76	1.49	1.66	3.6	5.9	1.13	1.26	0.16	0.24	3.39	0.42
	O1304	4	25	0.43	1.73	3.7	5.6	0.11	0.43	0.02	0.08	0.33	0.14
	O1308	4	56	0.28	2.10	3.6	5.0	0.15	1.18	0.02	0.22	0.45	0.39
	O1309	7	64	0.27	1.53	3.2	5.6	0.17	0.98	0.02	0.19	0.51	0.33
	P1102	24	24	0.59	1.18	3.0	6.3	0.14	0.28	0.02	0.05	0.42	0.09
	P1103	46	134	0.29	2.61	3.5	6.2	0.39	3.49	0.06	0.66	1.17	1.16
	P1105	82	202	0.75	1.69	3.5	6.4	1.51	3.4	0.22	0.65	4.53	1.14
	P1202	130	439	1.90	1.14	3.3	5.8	8.35	4.99	1.22	0.95	25.05	1.66
	P1202a	6	87	0.70	1.78	3.1	5.7	0.61	1.55	0.09	0.29	1.83	0.51
	P1205	5	46	0.63	1.28	3.0	5.9	0.29	0.59	0.04	0.11	0.87	0.19
	P1206	23	41	0.37	1.77	3.2	6.5	0.45	0.72	0.02	0.14	0.45	0.25
	P1207	40	77	0.59	1.20	3.4	6.5	0.45	0.93	0.07	0.18	1.35	0.32
	P1302	39	91	0.78	1.95	3.2	6.2	0.71	1.77	0.10	0.34	2.13	0.60
	P1306G	26	33	0.91	1.04	2.8	6.7	0.30	0.34	0.04	0.06	0.90	0.11
	P1308	4	18	0.40	1.25	2.0	5.6	0.07	0.23	0.01	0.04	0.21	0.07
	P1310	44	76	1.61	0.82	3.4	5.1	1.22	0.62	0.18	0.12	3.66	0.21
	P1403	48	108	0.16	2.04	3.7	6.3	0.17	2.21	0.02	0.42	0.51	0.74
	Q1102	247	569	1.31	1.14	3.3	6.2	7.46	6.46	1.09	1.23	22.38	2.15
	Q1102a	56	200	1.11	1.75	3.5	6.5	2.21	3.50	0.32	0.67	0.63	1.17

Table 2.4
The inventoried peat resources of Southwestern Nova Scotia.
Values are given for areas where peat depth exceeds 3 feet (1m) in depth.

Study Area	Deposit Number	Points Investigated	Area (ha)	Average Depth (m)		Average Humification		Volume (Mm³)		Million Tonnes		Million Bale Eq. Peat Moss Surficial	Million Barrels Eq. Light Oil
				Surficial	Humified	Surficial	Humified	Surficial	Humified	Surficial	Humified		
	Q1201	61	113	1.52	1.03	3.2	6.2	1.72	1.17	0.25	0.22	5.16	0.39
	Q1202	4	43	0.98	0.53	3.8	6.1	0.42	0.23	0.06	0.04	1.26	0.07
	Q1203	68	121	0.27	2.40	3.6	6.2	0.32	2.91	0.05	0.55	0.96	0.96
	Q1204G	192	634	1.12	2.16	3.5	6.0	7.11	13.68	1.04	2.60	21.32	34.55
	Q1207	42	47	1.24	0.82	3.3	6.1	0.58	0.39	0.08	0.07	1.74	0.12
	Q1208	6	35	0.85	1.57	3.5	5.7	0.30	0.55	0.04	0.10	0.90	0.18
	Q1209	185	490	1.07	1.37	3.3	6.1	5.26	6.72	0.77	1.28	15.78	2.24
	Q1211	3	87	1.80	0.20	3.1	5.0	1.57	0.17	0.23	0.03	4.71	0.05
	Q1303	7	185	1.87	1.16	3.3	6.1	3.46	2.14	0.51	0.41	10.38	0.72
	Q1304	3	41	1.17	0.47	3.1	5.7	0.48	0.19	0.07	0.04	1.44	0.07
	Q1305	92	240	1.53	1.22	3.2	5.8	3.68	2.93	0.54	0.56	11.04	0.98
	Q1306	43	91	1.46	1.59	3.3	5.8	1.33	1.45	0.19	0.28	3.99	0.49
	Other	16	129	1.45	1.78	3.8	5.9	1.65	1.98	0.24	0.38	4.95	0.67

Table 2.4 (con't)
The inventoried peat resoruces of Southwestern Nova Scotia.
Values are given for areas where peat depth exceeds 3 feet (1m).

Major Deposits

A total of 101 peat deposits were investigated in southwestern Nova Scotia. Although many of these may be suitable for peat moss, fuel peat, or other uses, only the more significant deposits will be discussed here in terms of their suitability for moss or fuel production.

Thirteen deposits favourable for fuel peat development, and one fairly good moss grade peat deposit, have been identified in southwestern Nova Scotia, particularly in the Lake Rossignol area. These deposits are discussed briefly below.

Four of the fuel grade deposits have very thin average surfical over burdens of moss grade peats in layers between 0.5 to 1 foot (.14 to 0.30 m). Two of these, First lake (Q1203) and Tobeatic East Bog (P1103), have fuel grade layers of significant depth, an average of between 2 feet and 8.5 feet (0.4-2.6 m). The others, Oak Park (U0712) and McGinty's Meadow Bog (P1403), are perhaps even more favourable, having roughly half the surfical overburden and comparable but slightly shallower fuel grade layers averaging 6.6 feet (2.0 m). These four deposits as a group show the highest average humifications in the region for both surficial and humified layers. Surficial layer humifications average between H_{3-5} and H_{3-7}, indicating that large areas may exist on these deposits where surfical overburdens would not have to be removed to access the more humified peats. Averages for fuel grade layers are between H_{6-2} and H_{7-0}, indicating a high quality fuel grade resource.

Six other deposits are also very favourable fuel peat resources but have slightly larger average thicknesses of surficial peats. Three of these, Makoke (S0501), Cape Sable (V0803), and Beartrap Swamp (U0723G) have fuel grade layers on average 7 to 9.2 feet (2.15 to 2.8 m) thick, while other deposits of this group, Clements Pond (U0812), Quinns Meadow (T0907a), and Rossignol Flowage Bog (P1102), are from 6.2 to 6.4 feet (1.94 to 1.95 m) in average thickness.Overall surficial overburdens in these deposits average 1.5 to 2.7 feet (0.45 to 0.83 m). All six deposits also have high average humifications for surfical and humified layers, but humification is slightly lower than the prime group of peatlands discussed above. Poorly humified surficial peats average H_{3-2} to H_{3-8} in humificiation, while humified layers are between H_{6-0} and H_{6-3} on the Von Post humification scale.

Three remaining fuel peat deposits which have been selected in this region show average surfical overburdens of between 3.7 and 4.5 feet (1.1 to 1.46 m). In the case of Haunted (Q1204a), and Savannah Bogs (T0709), these surficial layers are more acceptable due to higher average humifications (H_{3-6}). Quinan Bog (R0714) is less favourable with average surficial humifications of H_{3-0}. These deposits in all other respects are very similar to the previous six described.

One peatland, Rocky Lake Bog (P1202), has been identified as perhaps the best moss grade deposit in this region. This deposit has a moss grade layer averaging 6.2 feet (1.9 m) in thickness, with an average humification of H_{3-3}. This is a very large deposit situated on the North Shore of Lake Rossignol, but has at present very restricted access.

2.3.3 Peat Resources of Hants County

Regional Environmental Setting and Peatland Development

Physiography

The major peatland resources of this region occur north of the Kennetcook River, near Stanley (Figure 2.14). The deposits were probably formed in lake and pond basins left in the tills after the last deglaciation. Tills in the area were derived locally from red to grey-brown sandstones and siltstones, resulting in fairly sandy-clayey loams throughout the region(Cann et al 1954a; Stea and Fowler 1979).

Climate

The region has a typically Maritime climate which does not differ significantly from the rest of the Province. The frost free period is roughly 100 to 130 days, beginning in late May and lasting until early September. Summer precipitation averages about 2 to 3 inches (5 to 18 cm) out of 14 inches (35 cm) annually.Evapotranspiration often exceeds precipitation, leaving soil moisture deficits in some areas. These conditions compare with those of northeastern New Brunswick and the Annapolis Valley, where peat harvesting currently takes place. Thus, the climate in Hants County would be very suitable for peat harvesting.

Peatland Development

The deep basins within poorly drained tills of Hants County were initially sites of lakes or ponds which began infilling shortly after deglaciation about 10,000 years ago. The rapid growth and accumulation of peat in these basins has led to the development of some of the provinces deepest peat resources (often over 26 feet (8 m) in depth). The resulting peat deposits are often significantly raised, although there are a number of less developed deposits such as basin bogs in the region.

Peatland Vegetation

The bogs surveyed in Hants County were found to be the most heavily treed in the province. On average, 40 percent of the surface area of deposits thicker than 3 feet (1m) had tree cover greater than 10 percent. For the most part the understory of treed peatlands were dominated by low ericaceous shrubs. Graminoid cover on peatlands in this region occurred infrequently. Roughly 7 percent of the area of the deposits greater than 3 feet (1 m) in depth was occupied by graminoid cover.

Size and Distribution of Peatland Resource

Overview

The inventory program investigated 39 percent of the total peatland in Hants County. Approximately 5,700 acres (2 307 ha) were surveyed of which 3,680 acres (1 450 ha) had peat thicknesses in excess of 3 feet (1 m).

Indicated resources in deposits thicker than 3 feet (1 m) are 57.9 million cubic yards (44.3 Mm³) of surficial peats and 30.6 million cubic yards (23.4 Mm³) of humified peats. This equates to 7.1 million tons (6.46 Mte) of moss grade and 4.89 million tons (4.44 Mte) of fuel grade peat. Conversions are based on relative in situ tonnage of resources at 50 percent moisture content. Only 41 percent of the peat resource was found to be of fuel grade.

Moss grade resources are estimated to be around 132.81 million bales, while the heat value of fuel grade peats could represent the equivalent of 7.77 million barrels of light fuel oil (Table 2.5).

Surficial peat layers in the bogs of this region are quite thick, averaging 10 feet (3.04 m). The peat is almost exclusively pure *Sphagnum*. However the occurence of ericaceous shrubs tends to be higher than in any other region of the province.

The humified peat layers are usually 5 feet (1.5 m) or less in thickness with a humification value of about $H_{4\cdot8}$ to $H_{5\cdot1}$, significantly lower than that of southwestern Nova Scotia. This is probably due to the higher frequency of less humified *Sphagnum* and sedge peats near the bottom of the peat profile. Due to the thick accumulation of peat moss overlying this humified layer, the fuel peat resources of this region are not considered to be suitable for development.

Major Deposits

Virtually all of the fifteen individual peatland deposits surveyed in Hants County contain large volumes of moss grade peat (Figure 2.14).

Seven of the larger deposits have been selected as highly favourable peat moss areas. These deposits are part of the main group of peatlands near the community of Stanley. One other deposit, far removed from this area, may have some potential as a suitable fuel peat resource.

Petite (H2107), Barrens West (I2002), and Colin Bog (I2104), have thicker moss grade peats than other deposits chosen. Surficial layers of these peatland average 11.2 to 12.0 feet (3.4 to 3.67 m) in depth. Three other deposits-East Meadow (H2006), MacDonald (H2208), and Barrens East Bog (I210)-have slightly shallower but still some of the thickest moss grade layers in the province. These deposits typically have poorly humified peats averaging 10 to 10.3 feet (3.04-3.13 m) in thickness, a substantial moss resource. The Mosherville Bog (I2106) is the smallest moss grade deposit of the group and has a significantly thinner surficial layer which averages 6.5 feet (2.06 m) in depth.

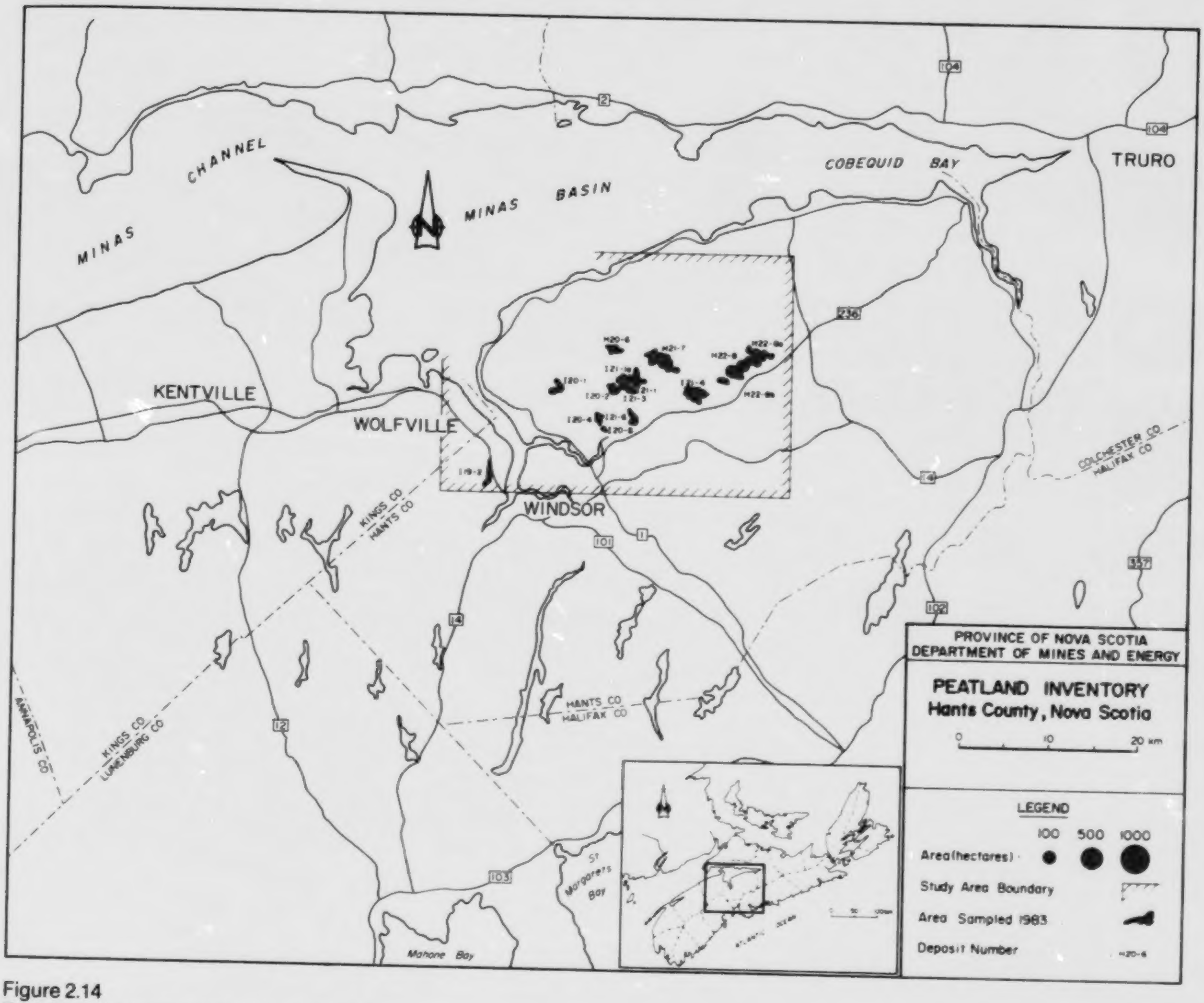

PROVINCE OF NOVA SCOTIA
DEPARTMENT OF MINES AND ENERGY
PEATLAND INVENTORY
Hants County, Nova Scotia
0
10
20 km
LEGEND
100
500
1000
Area (hectares)
Study Area Boundary
Area Sampled 1983
Deposit Number
H20-6
MINAS CHANNEL
MINAS BASIN
COBEQUID BAY
TRURO
KENTVILLE
WOLFVILLE
WINDSOR
H20-6
H21-7
H22-8
H22-8a
H22-8b
I20-1
I20-2
I21-1a
I21-1
I21-3
I21-4
I20-4
I21-6
I20-5
I19-2
KINGS CO
HANTS CO
COLCHESTER CO
HALIFAX CO
ANNAPOLIS CO
LUNENBURG CO
St Margarets Bay
Mahone Bay
2
104
236
14
101
1
102
357
12
103

Figure 2.14
Peat deposits inventoried in Hants County.

Study Area	Deposit Number	Points Investigated	Area (ha)	Average Depth (m)		Average Humification		Volume (Mm³)		Million Tonnes		Million Bale Eq. Peat Moss Surficial	Million Barrels Eq Light Oil
				Surficial	Humified	Surficial	Humified	Surficial	Humified	Surficial	Humified		
Hants County	H2006	26	88	3.04	1.37	3.0	5.0	2.67	1.20	0.39	0.23	8.01	0.40
	H2107	118	342	3.40	1.79	3.3	5.1	11.63	6.13	1.70	1.16	34.89	2.03
	H2208	155	467	3.10	1.30	3.2	5.2	14.47	6.09	2.11	1.16	43.41	2.03
	I1902	8	56	0.81	2.60	3.6	5.4	0.46	1.46	0.07	0.28	1.38	0.49
	I2002	7	54	3.49	0.96	3.2	5.0	1.88	0.52	0.27	0.10	5.64	0.18
	I2101	10	92	3.13	2.48	3.1	5.2	2.88	2.28	0.42	0.43	8.64	0.75
	I2104	85	202	3.67	1.22	3.3	5.0	7.41	2.46	1.08	0.47	22.23	0.82
	I2106	27	56	2.06	2.28	3.4	5.1	1.15	1.28	0.17	0.24	3.45	0.42
	Others	33	133	1.28	1.47	2.8	5.4	1.72	1.96	0.25	0.37	5.16	0.65

Table 2.5
The inventoried peat resources of Hants County.
Values are given for areas where peat depth exceeds 3 feet (1m).

All of the deposits described as potential moss peat resources in this area have surficial peats which have an average humification value of H_{3-0} to H_{3-4} and humified layers averaging H_{5-0} to H_{5-2}. Humification values for the fuel grade peats in the bog are quite low, indicating that upper portions of these layers may also be harvested as peat moss.

The one potential fuel grade deposit identified from inventory data in Hants County is Shaws Bog (I1902), near Falmouth. It is small in area in comparison to fuel grade deposits found in Southwestern Nova Scotia, but has an average surficial overburden of only 2.7 feet (0.81 m), with an average humification value of H_{3-6} (the highest in this area and quite comparable to values for other fuel grade deposits). This deposit, and only a few others in the province, has a thick fuel grade layer, averaging 8.5 feet (2.6 m). The average humification value of this layer, however, is considerably lower than fuel peat layers in other deposits (generally around H_{5-4}), which may indicate interbedded lenses of poorly humified peat. This may make this deposit less attractive for development as a fuel peat harvesting area.

2.3.4 Peat Resources of Cumberland County

Regional Environmental Setting and Peatland Development

Physiography
The majority of peatlands in Cumberland County are found in shallow depressions in the tills of the Cumberland Basin (Figure 2.15). This region has fairly thick accumulations of lodgement tills overlying late Carboniferous sedimentary rock. In the northern part of this region, near the New Brunswick border, large areas of poorly drained terrain created by the sediment laden waters of the Bay of Fundy, have developed into vast areas of peatland and marshes. The western section of the Cumberland plain, along Chignecto Bay, is predominantly overlain by tills thinner than found in the marsh areas. The combination of the poorly drained, stoney soils, thin tills and underlying bedrock, has created an undulating topography with many poorly drained depressions occupied by peat deposits (Nowland and MacDougall 1973).

Climate
Cumberland County has a climate typical of the Maritime Region. It experiences cool and moist conditions, with local weather not unlike the remainder of the Nova Scotia. The frost free period, usually from late May to early September, is somewhat shorter than that of southern Nova Scotia. However, evapotranspiration rates often exceed precipitation, creating soil moisture deficit in some areas. These parameters compare favourably to conditions that exist in northeastern New Brunswick and the Annapolis Valley, where peat is currently harvested.

Peatland Development
Most surveyed deposits of the Cumberland County region have developed in relatively shallow basins, often confined either by folds in the sedimentary rocks or by low till mounds and other glacial drift. Deposits in the Tantramar Marsh-Missaquash Marsh areas, however, appear to have developed in depressions in the silty-clayey loams associated with the poorly drained marshland areas. Extensive flat, floating, peat mats are found in peatlands associated with marsh areas of the region. Although a few basin and sloped peat deposits occur in the region, most of the bog areas were elongated "raised" or "domed" bogs.

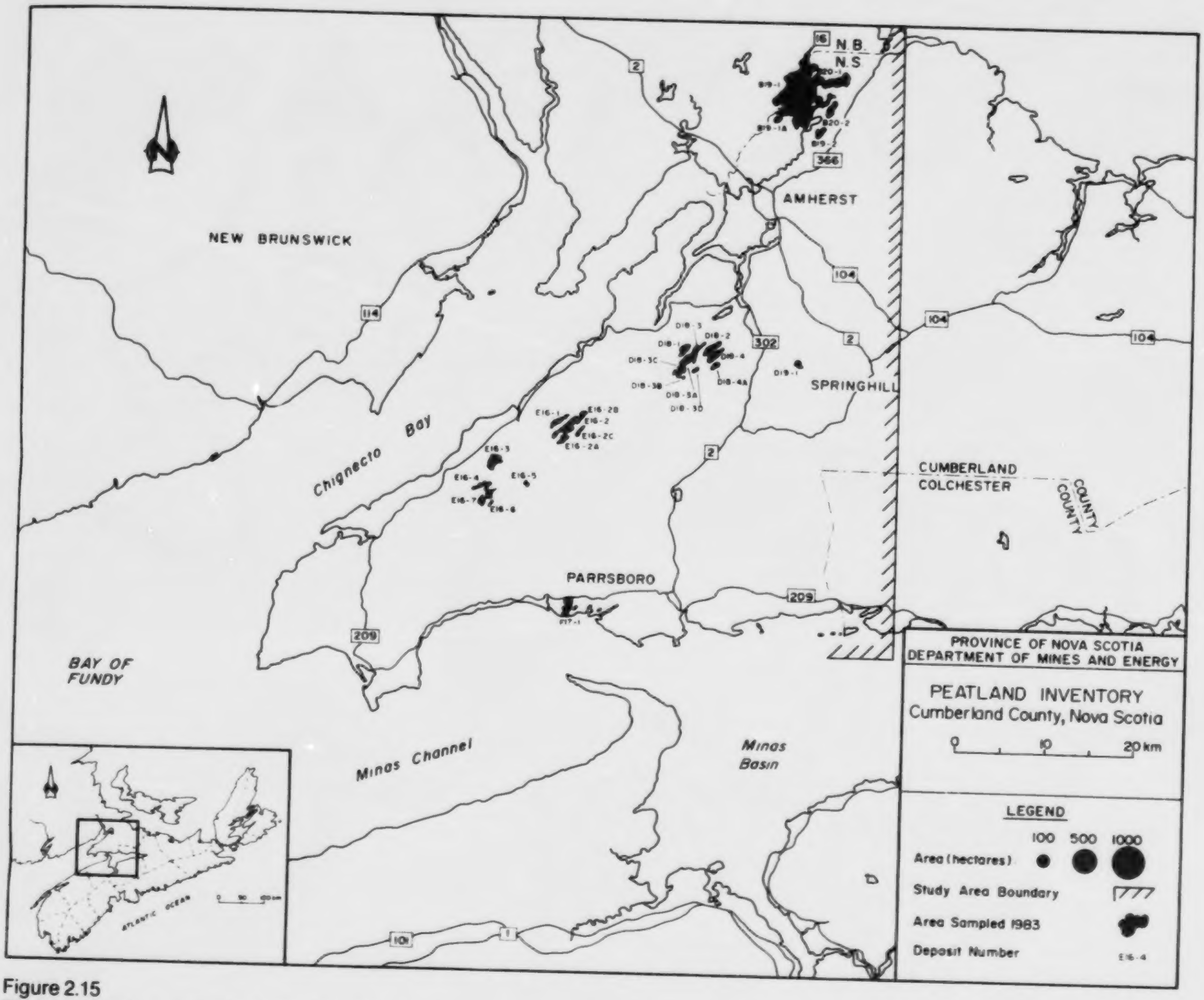

NEW BRUNSWICK
N.B.
N.S.
AMHERST
SPRINGHILL
PARRSBORO
Chignecto Bay
BAY OF FUNDY
Minas Channel
Minas Basin
CUMBERLAND COUNTY
COLCHESTER COUNTY
ATLANTIC OCEAN
B19-1
B19-1A
B19-2
B20-1
B20-2
D18-1
D18-2
D18-3
D18-3B
D18-3C
D18-3A
D18-3D
D18-4
D18-4A
D19-1
E16-1
E16-2
E16-2A
E16-2B
E16-2C
E16-3
E16-4
E16-5
E16-6
E16-7
E17-1
2
16
366
104
114
302
209
101
1
PROVINCE OF NOVA SCOTIA
DEPARTMENT OF MINES AND ENERGY
PEATLAND INVENTORY
Cumberland County, Nova Scotia
0 10 20 km
LEGEND
Area (hectares) 100 500 1000
Study Area Boundary
Area Sampled 1983
Deposit Number E16-4

Figure 2.15
Peat deposits inventoried in Cumberland County.

Study Area	Deposit Number	Points Investigated	Area (ha)	Average Depth (m)		Average Humification		Volume (Mm³)		Million Tonnes		Million Bale Eq. Peat Moss Surficial	Million Barrels Eq. Light Oil
				Surficial	Humified	Surficial	Humified	Surficial	Humified	Surficial	Humified		
Cumberland County	B1901	141	1093	1.59	0.51	2.6	5.3	17.35	5.56	2.53	1.06	52.05	1.86
	B1902	38	56	2.41	1.13	2.8	5.8	1.35	0.64	0.20	0.12	4.05	0.22
	B2001	53	111	1.38	0.98	2.7	6.3	1.53	1.09	0.22	0.21	4.59	0.37
	B2002	47	71	2.46	1.45	2.9	5.8	1.74	1.03	0.25	0.20	5.22	0.35
	D1801	16	31	1.66	0.45	3.6	6.4	0.52	0.14	0.08	0.03	1.56	0.05
	D1803	57	116	1.86	1.58	3.3	5.8	2.16	1.83	0.32	0.35	6.48	0.61
	D1804	33	57	1.81	1.39	3.3	6.0	1.03	0.79	0.15	0.15	3.09	0.26
	D1901	9	73	2.85	0.94	2.8	5.6	2.08	0.69	0.30	0.13	6.24	0.23
	E1601	26	52	1.70	2.40	3.2	5.7	0.88	1.25	0.13	0.24	2.64	0.42
	E1602	31	61	1.12	1.18	2.9	6.3	0.69	0.72	0.10	0.14	2.07	0.25
	E1603	29	43	2.36	0.76	3.1	5.7	1.01	0.33	0.15	0.06	3.03	0.11
	E1604	18	20	2.63	0.91	3.1	5.8	0.53	0.18	0.08	0.03	1.59	0.05
	E1606	15	22	2.34	0.91	3.0	5.7	0.51	0.20	0.07	0.04	1.53	0.07
	E1607	19	36	2.41	1.90	3.1	5.7	0.87	0.68	0.13	0.13	2.61	0.23
	E1701	42	56	1.12	1.52	3.3	5.8	0.63	0.85	0.09	0.16	1.89	0.28
	Other	23	83	1.20	1.35	2.7	5.9	1.02	1.21	0.15	0.23	3.06	0.40

Table 2.6
The inventoried peat resource of Cumberland County.
Values are given for areas where peat depth exceeds 3 feet (1m).

Peatland Vegetation

Cumberland County peat deposits are dominated by open areas of low ericaceous shrubs with some fairly large graminoid (grass) areas, particularly in Missaguash Marsh, where some significant fen areas have also been mapped. Treed bog cover types made up roughly 27 percent of the surface area of deposits greater than 3 feet (1 m) deep. However, as in other regions of the province, the most prevalent treed cover had a shrub rich understory. Peatlands such as alder or thicket swamps were also quite common and tended to be associated with peat margins as in the Lake Rossignol region of southwestern Nova Scotia.

Size and Distribution of Peatland Resource

Overview

Roughly 68 percent of the Cumberland County peat resource has been surveyed, amounting to 10,100 acres (4 081 ha) of peatland. Areas mapped as having peat thicknesses in excess of 3 feet (1 m), exceed 5,100 acres (2 060 ha). Surficial or moss grade peats associated with this area have a total volume of 46.2 million cubic yards (35.3 Mm^3); fuel grade volumes are approximately 24 million cubic yards (18.5 Mm^3). These volumes are calculated to represent some 5.8 and 3.9 million tons (5.2 and 3.5 Mte) of moss and fuel grade peat resource respectively (Table 2.6). Fuel grade peats in this area thus represent only 41 percent of the total resource, a similar percentage to that in Hants County.

"Surficial" or "moss" grade peat layers of the surveyed deposits in Cumberland County averaged 5.8 feet (1.8 m) thick. However in some deposits this layer was over 9 feet (2.8 m) in thickness. The average thickness of the moss grade layer in the region is considerably larger than the average for Southwestern Nova Scotia. The surficial peat in Cumberland County bogs has an average humification of $H_{3\text{-}0}$ and consists primarily of *Sphagnum* based peat, with less than 10 percent frequency of sedge and shrubs constituents.

The humified layers of peat in the region averaged 3.8 feet (1.15 m) in thickness. However they were usually beneath 5 to 6 feet (1.7 to 1.8 m) of peat moss, making them relatively uneconomic for exploitation. These fuel grade peats are *Sphagnum* based, with the sedge and shrub constituents occurring frequently in the basal peats. Some *Carex* or sedge dominant peats were also found near the bottom of the deposits, but usually in very small 4 to 8 inch (10 to 20 cm) lenses. Humified peat averaged $H_{5\text{-}8}$, indicating a fairly good quality of fuel.

The overall average depth of peat (moss and fuel grade) deposits doesn't appear to be significantly different than in southwestern Nova Scotia.

Major Peat Deposits

Twenty-five deposits have been inventoried in Cumberland County, of which two bogs in the Missaguash Marsh area near Amherst, and one near Athol, appear to have significant peat moss production potential (Table 2.6).

The South Athol Bog (D1901), although small and quite heavily treed, had a thick layer of moss grade peat. The layer is on average 9.3 feet (2.83 m) thick, and had an average humification of $H_{2\text{-}8}$, one of the lowest in the province. Two deposits near Amherst, West Tignish (B2002) and MacLellan's Brook Bog (B1902), had slightly shallower surficial layers averaging 8.1 and 7.9 feet (2.46 and 2.41 m) in thickness, are fairly heavily treed, and also have very low average surficial humifications of $H_{2\text{-}8}$ and $H_{2\text{-}9}$, indicating some very high quality peat moss.

The region's largest deposit in terms of surface area, Missaguash Bog (B1901) (2700 acres [1093 ha] of deposit thicker than 3 feet [1m]), did not have significant peat moss production potential. This deposit, averaging only 6 feet (2.0 m) in total thickness, is very susceptible to flooding as a result of waterfowl management programs carried out in the area.

2.3.5 Peat Resources of Guysborough County

Regional Environmental Setting and Peatland Development

Physiography

Most of Guysborough County's peat resource lies in the coastal uplands, which extend from the Liscomb River eastward to Canso, south of the West Branch St. Mary's River and the Salmon River (Figure 2.16). The coastal uplands consist primarily of metasedimentary and intrusive rocks that have been eroded by glaciation. For the most part the locally derived, sandy tills are quite thin or non-existent, resulting in a number of rocky barrens with peat deposits occurring in localized hollows and depressions (Stea and Fowler 1979; Hilchey *et al* 1964).

Climate

The climate of coastal and upland areas of Guysborough County is moderated by the nearby Atlantic Ocean. Conditions are moist and cool, frequently influenced by fog penetrating deep inland along the major river valleys. The frost free period extends from mid to late May to late September or early October. Potential evapotranspiration rates would rarely create significant soil moisture deficits, especially in the coastal regions of the county. However, it is anticipated that production levels on some of the larger, more inland, peat deposits could be comparable to those on deposits in northern Nova Scotia.These considerations are presented more fully later in this report (Section 2.5).

Peatland Development

The peat deposits of Guysborough County and eastern Halifax County are somewhat similar. Deposits tend to be very small or, if large, are formed by the coalescing of several small deposits into peatland complexes of varying sizes.

A number of deposits in the Sherbrooke-Glenelg area have developed in fairly extensive till depressions, and appear to have been at one time a series of small bodies of water which infilled, creating a large group of deep domed, ombrotrophic, peatlands. Similar features are also evident in the Bull Ridge area near Country Harbour, and on a number of headlands along the coast.

Most of the bogs in Guysborough County have developed into raised or domed bogs, often showing distinct concentric and eccentric hummock-hollow formations. Very few minerotrophic deposits, but many highly ombrotrophic deposits, were found in this region.

Peatland Vegetation

The surface cover of bogs in Guysborough County is quite similar to the coastal deposits of Southwestern Nova Scotia and eastern Cape Breton Island. The bogs are predominantly open, with very large graminoid or "Scirpus lawn" areas associated with deposits closer to the coast. Low shrub cover was most frequent on inland bogs or in areas near the margin of coastal deposits. Tree cover occurred primarily in shallow peat areas or near the bog margins.

Size and Distribution of Peatland Resource

Overview

Roughly 25 percent of Guysborough County's peat resource was inventoried by this program. A total of 8,685 acres (3 515 ha) were surveyed, and 4,890 acres (1 979 ha) had an average depth over 3 feet (1m).

The inventoried deposits were estimated to have 47.9 million cubic yards (36.7 Mm^3) of surficial or moss grade peat and roughly 27.1 million cubic yards (20.7 Mm^3) of fuel grade or humified peat. These resource volumes are roughly equivalent to 6.2 and 4.4 million tons (5.4 and 3.9 Mte) of in situ peat (at 50 percent moisture content) respectively. The surveyed peat moss resource would be equivalent to 110 million bales of moss (Table 2.7).

The surficial peat layers in this region averaged 6 feet (1.8 m) in depth, similar to thicknesses in Cumberland County and the Cape Breton Highlands, and were quite poorly humified ($H_{3\text{-}1}$). Although they were predominantly *Sphagnum* based, the peats were strongly permeated with the long fibrous roots of *Scripus* or deergrass. Fuel peat layers averaged roughly 3 feet (1.03 m) in thickness and were poorly humified ($H_{4\text{-}1}$). The peat was composed primarily of *Sphagnum* with a noticable lack of *Carex* (sedge) constituents in the basal layers.

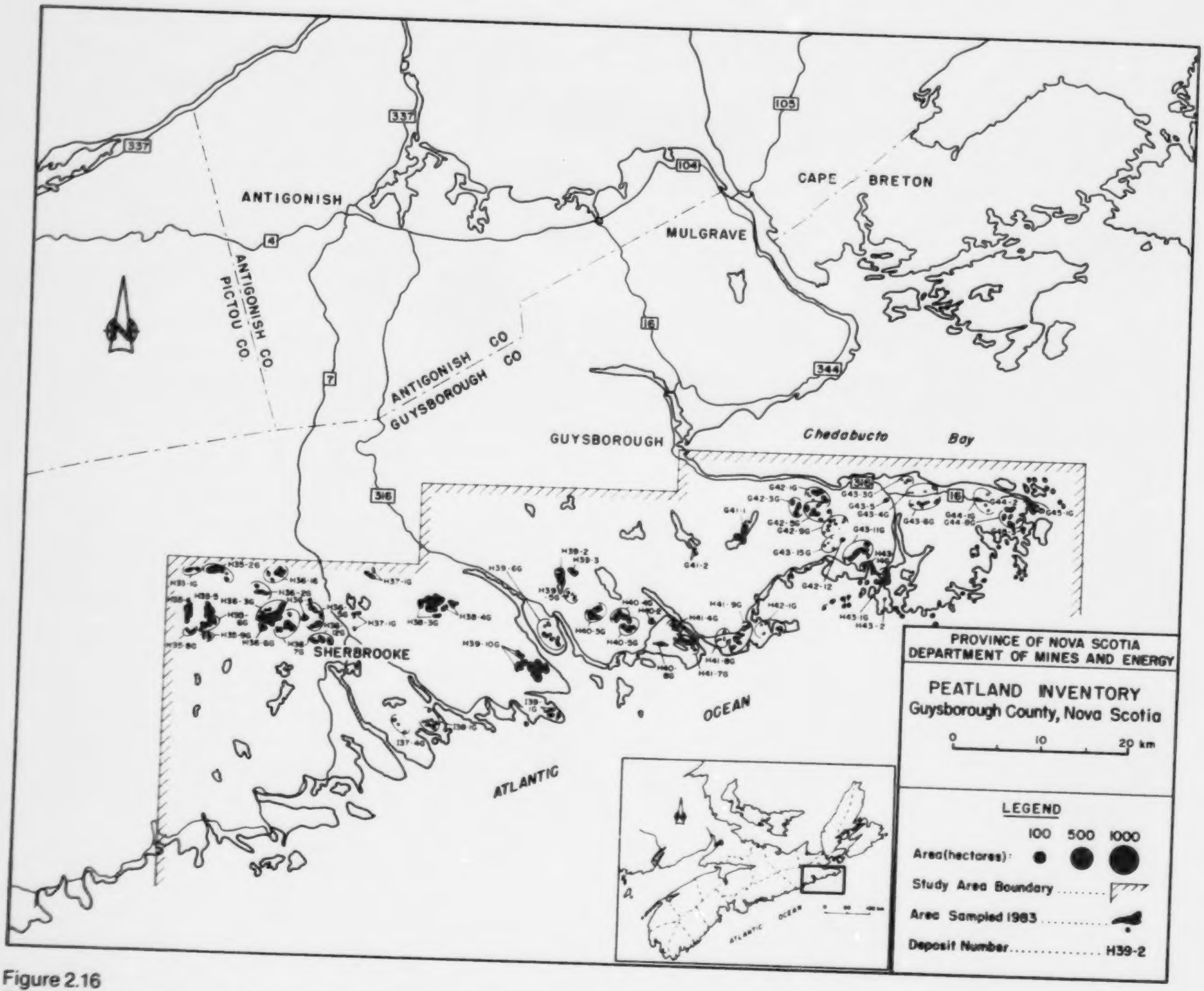

ANTIGONISH
ANTIGONISH CO.
PICTOU CO.
ANTIGONISH CO
GUYSBOROUGH CO
CAPE BRETON
MULGRAVE
GUYSBOROUGH
Chedabucto Bay
SHERBROOKE
ATLANTIC OCEAN
N
337
104
105
4
7
16
316
344
PROVINCE OF NOVA SCOTIA
DEPARTMENT OF MINES AND ENERGY
PEATLAND INVENTORY
Guysborough County, Nova Scotia
0 10 20 km
LEGEND
Area(hectares): 100 500 1000
Study Area Boundary
Area Sampled 1983
Deposit Number H39-2
H39-6G
H39-10G
H38-4G
H38-3G
H37-1G
H41-9G
H42-1G
G41-1
G41-2
G42-1G
G42-3G
G43-3G
G43-11G
G43-15G
G42-12
G45-1G

Figure 2.16
Peat deposits inventoried in Guysborough County.

Study Area	Deposit Number	Points Investigated	Area (ha)	Average Depth (m)		Average Humification		Volume (Mm³)		Million Tonnes		Million Bale Eq. Peat Moss Surficial	Million Barrels Eq. Light Oil
				Surficial	Humified	Surficial	Humified	Surficial	Humified	Surficial	Humified		
Guysborough County	G4201	33	32	1.63	1.60	3.2	4.7	0.52	0.51	0.08	0.10	1.56	0.18
	G4205a	10	34	1.63	0.96	3.2	4.5	0.56	0.32	0.08	0.06	1.68	0.11
	G4311a	62	93	1.36	0.97	3.2	4.3	1.27	0.90	0.19	0.17	3.81	0.30
	G4402	4	33	3.65	0.40	2.8	4.5	1.20	0.13	0.18	0.02	3.60	0.04
	G4408a	6	46	1.85	1.23	2.8	4.0	0.85	0.57	0.12	0.11	2.55	0.19
	H3502a	36	62	2.02	1.10	3.1	4.3	1.25	0.68	0.18	0.13	3.75	0.23
	H3054	37	50	2.27	1.11	3.1	4.1	1.14	0.55	0.17	0.10	3.42	0.18
	H3505	44	55	2.63	0.46	3.1	4.9	1.45	0.25	0.21	0.05	4.35	0.09
	H3601a	7	41	0.50	1.50	3.3	3.9	0.21	0.62	0.03	0.12	0.63	0.21
	H3602a	7	27	1.65	0.95	2.9	3.9	0.45	0.26	0.07	0.05	1.35	0.09
	H3603a	97	195	2.09	0.78	3.2	4.3	4.08	1.51	0.60	0.29	12.34	0.51
	H3605a	10	55	2.61	0.49	3.0	5.2	1.44	0.27	0.21	0.05	4.32	0.09
	H3606a	9	51	1.00	1.20	3.0	3.5	0.51	0.61	0.07	0.12	1.53	0.21
	H3607a	7	55	1.70	1.39	3.4	4.0	0.94	0.76	0.14	0.14	2.82	0.25
	H3612a	8	56	3.13	0.75	2.9	5.6	1.75	0.42	0.26	0.08	5.25	0.14
	H3701a	3	27	1.87	0.37	3.1	5.3	0.50	0.10	0.07	0.02	1.50	0.04
	H3803	67	110	1.02	14.80	3.2	3.7	1.13	1.63	0.16	0.31	3.39	0.54
	H3902	13	25	1.43	0.76	3.0	5.2	0.36	0.19	0.05	0.04	1.08	0.07
	H3910a	151	170	1.80	0.85	3.2	4.0	3.06	1.45	0.45	0.28	9.18	0.49
	H4003a	16	29	2.46	0.50	3.1	5.0	0.71	0.15	0.10	0.03	2.13	0.05
	H4004a	23	51	1.39	1.56	3.2	3.6	0.71	0.80	0.10	0.15	2.13	0.26
	H4005a	38	49	2.10	0.54	3.0	5.0	1.03	0.26	0.15	0.05	3.09	0.09
	H4109a	9	44	1.96	1.04	3.3	4.0	0.86	0.46	0.13	0.09	2.58	0.16
	I3704a	3	28	3.25	0.50	3.2	5.7	0.91	0.14	0.13	0.03	2.73	0.05
	I3810a	7	28	2.27	0.81	3.2	5.2	0.64	0.23	0.09	0.04	1.92	0.07
	I3901a	6	34	3.03	0.62	2.9	5.4	1.03	0.21	0.15	0.04	3.09	0.07
	Others	200	499	2.80	1.38	3.2	4.3	8.07	6.74	1.18	1.28	24.21	2.24

Table 2.7
The inventoried peat resources of Guysborough County.
Values are given for areas where peat depth exceeds 3 feet (1 m).

Major Deposits

Many peatland areas inventoried in this region are groups or clusters of relatively small deposits which, for logistical reasons, have been processed and mapped as single deposit groups. These have been designated with a "G" subletter as part of the bog identification number. Fifty-eight individual bogs or deposit groups have been investigated in Guysborough County.

Five peatlands or groups of peatlands represent significant moss peat resources in this region.No deposits were selected as significant fuel grade resources, due to fairly thick surficial moss peat overburdens and generally thin, poorly humified, fuel grade layers.

Two deposits, Taylors Bog (H3505) and Moose Bog (H3504), had substantial moss grade layers averaging 7.5 feet to 8.6 feet (2.27 to 2.63 m) thick with an average humification value of H_{3-1}. These deposits, like others in the area and in Guysborough County in general, show very low average humifications for fuel grade layers, a feature which may indicate that in many cases, harvestable moss grade layers can be extended well into the upper portions of humified layers. Average humification of the humified peats of these two deposits are between H_{4-1} and H_{4-9}. Taylor's and Moose Bogs are relatively small but are adjacent, and may be combined for a total harvestable area of 260 acres (105 ha).

A third deposit, "Big Bog " (H3603G), had a slightly thinner average surficial layer of 6.9 feet (2.09 m), but as in the previous two deposits,the moss peat layer was underlain by poorly humified peats. This large group of bogs represents the largest peatland complex inventoried in the region (482 acres [195 ha]).

Bullridge (H3803) and Squinces Meadows (H3910G) do not appear to have sufficient moss grade peat thickness to qualify as good moss peat resources. The average surficial depth of Bullridge Bog was 3 feet (1.0 m) and Squinces Meadows, 6 feet (1.8 m). However, due to the large size of these deposits and the presence of poorly humified underlying layers, they are considered very promising moss peat resources.

2.3.6 Peat Resources of Cape Breton Island

Regional Environmental Setting and Peatland Development

Physiography

Most of Cape Breton Island's peatland resource is found in three physiographic regions: the eastern Coastal Plains, the Sydney Basin, and the Cape Breton Highland Plateau (Figures 2.17 and 2.18).

The eastern coastal plains of Cape Breton Island are composed of a number of major geologic units that distinctly affect the topography. The region is dominated by Forchu basalts, tuffs, and rhyolites overlain by Devonian-Carboniferous and Carboniferous sediments (Keppie 1979). Inland areas of this region have a relatively low lying, rolling topography, while coastal areas are relatively level and dip gently to the sea. Tills have an average depth of about 60 feet (18 m), but are generally thinner along the coast where exposed bedrock may occur (Cann *et al* 1954b). Soils derived from the sandstone, quartzite, and shale tills, are generally less well drained in coastal areas.

The Sydney Basin is composed of coal bearing late Carboniferous shale and sandstone strata extending northward from the Mira River and East Bay Hills, and under the Cabot Strait (Keppie 1979). Surficial deposits in these lowland regions are generally thick tills with sand and gravel deposits, resulting from glacial and glaciofluvial action several thousand years ago in the outward plains. In upland areas, these tills become stoney or coarse and can be quite thin or even absent, leaving exposed bedrock in many locations (Cann *et al* 1954b). Fairly level and gently undulating, well drained soils, derived from stoney sandy loam tills, are common in inland areas, while flatter coastal areas have more poorly drained soils derived from the same material (Cann *et al* 1954b).

The bedrock of the Cape Breton Highland Plateau consists primarily of Precambrian granites and meta volcanics. The highlands can be described as the eroded remains of a tilted peneplain rising northward and from east to west. The highest elevation is found west of Ingonish (approximately 1750 feet [516 m]), where the plateau tends to level off and gently slopes down to the north (Cann *et al* 1954b; Keppie 1979; MRMS *et al* 1984).

Surficial deposits resulting from glaciation and glaciofluvial action over the highland areas, generally form a relatively thin veneer of sandy-stoney tills that deepen substantially when filling depressions in the bedrock topography. Peat deposits are found usually in depressions in the exposed bedrock or on poorly drained soils (Cann *et al* 1954b; MRMS *et al* 1984).

Climate

The weather conditions experienced on Cape Breton Island vary significantly from one area to the next.

The Sydney Basin and Coastal Plains experience moderate temperatures with a fairly cool, moist summer period. The frost free period ranges from 80-190 days throughout the region, but is usually between 116-160 days (3 months). This is comparable to other regions of the province, indicating fairly good production capabilities may be achieved from local peat deposits.

In contrast, the Cape Breton Highlands are infamous for their inclement weather conditions. The frost free period for the plateau is about 60 days, ranging from 32-90 days, while for coastal areas it averages 156 days (136-188 days). The relatively high altitude has shortene the peak summer period to July and August. The cool, moist, climate of the plateau is ideal for peat growth, which usually accumulates as blanket bogs on poorly drained terrain.

Peatland Development

The majority of peat deposits on Cape Breton Island are "raised" or "domed" bogs, with a large number of coast "raised" or Atlantic Plateau bogs found along the Island' eastern coast. The peat deposits of the Cape Breton Highland plateau are typical of more northerly latitudes. Although raised or domed bogs can be found on the Highland plateau, the peatlands there are typically blanket and string bogs, often closely associated in the poorly drained upland soils.

Peat deposits in the low lying Sydney Basin and Coastal Plain regions are usually formed in lake depressions, while those in upland areas are initiated in small depressions or on poorly drained slopes. The bog in the eastern coastal zone tend to be "domed", and are often exposed at the coast or bordering on cobble beaches. Numerous flat bogs are also found throughout the area. Peat thickness in the Sydney Basin and Coast Plain is not signficantly different from other regions of th Province, but deposits are about 3 feet (1 m) thicker thar in the Highlands. The difference is believed to be related to topography and climate.

Peat deposits surveyed on the remainder of the Islanc were similar to those studied in other regions of the Province. One exception was a deposit found at Black River, near the western end of Lake Ainslie. This flat bog occurring in the former lake bottom, supports many forms of flora not previously noted on other deposits inventoried by this program.

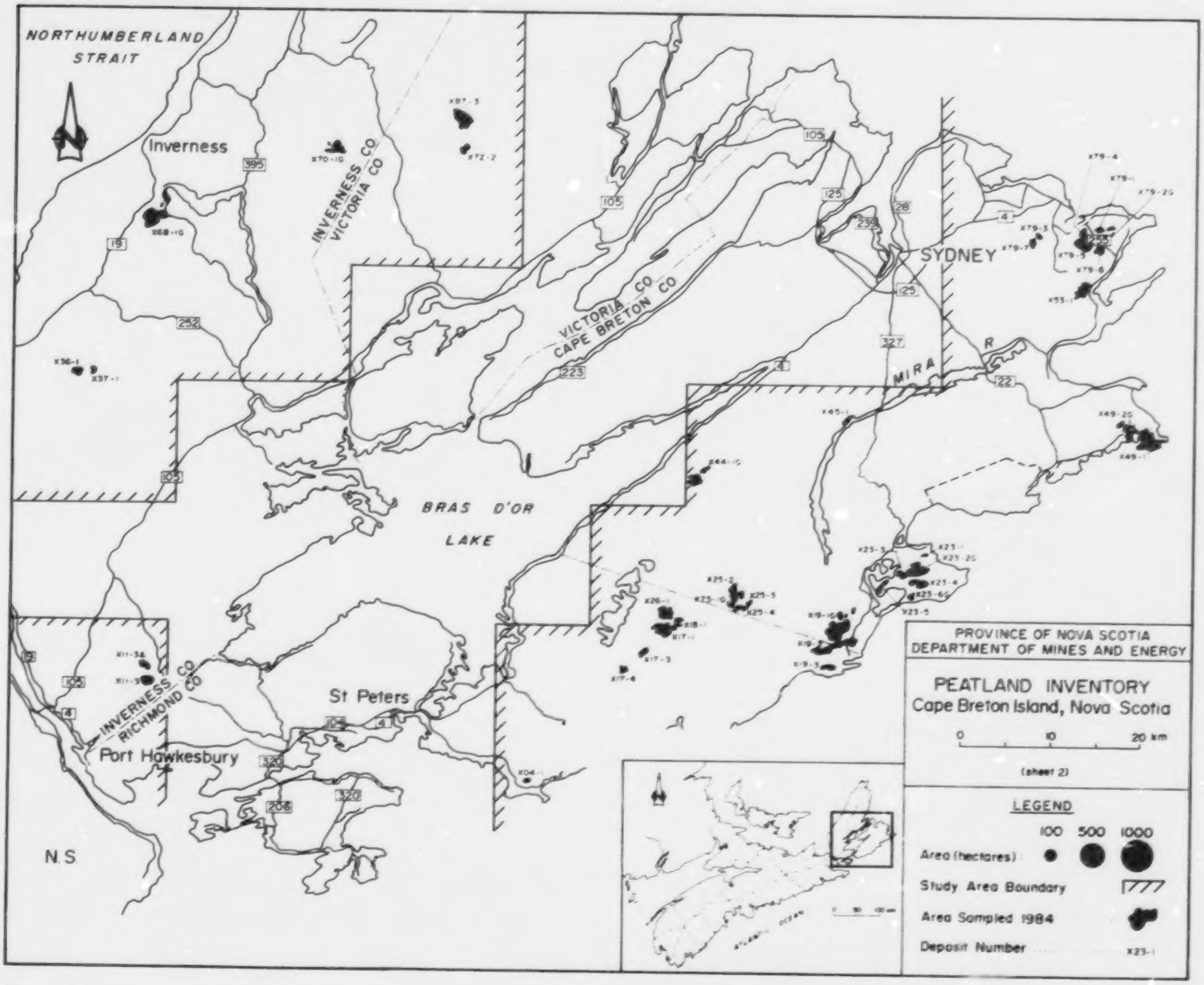

NORTHUMBERLAND STRAIT
Inverness
INVERNESS CO
VICTORIA CO
VICTORIA CO
CAPE BRETON CO
SYDNEY
MIRA R
BRAS D'OR LAKE
INVERNESS CO
RICHMOND CO
St Peters
Port Hawkesbury
N.S.
PROVINCE OF NOVA SCOTIA
DEPARTMENT OF MINES AND ENERGY
PEATLAND INVENTORY
Cape Breton Island, Nova Scotia
0
10
20 km
(sheet 2)
LEGEND
100
500
1000
Area (hectares)
Study Area Boundary
Area Sampled 1984
Deposit Number
x23-1

Figure 2.17
Peat deposits inventoried in eastern Cape Breton Island.

Peatland Vegetation
Peatlands occurring in the lowland areas of the Sydney Basin and Eastern Coastal Plains were very similar to deposits occurring along the eastern coast of mainland Nova Scotia. Surface cover was dominated by open deer grass (*Scirpus* sp.) lawns, subdominated by ericaceous shrubs. Tree cover was usually limited to drainage tracts, shallow peat areas, and peatland margins.

The inland deposits were primarily dominated by low shrubs, particularly where minerotrophic conditions existed (i.e. Black River, River Inhabitant and Centerville Bogs). These bogs also had substantial tree cover. The Black River Bog had large expanses of coniferous bog and swamp areas, and had perhaps the largest deciduous treed bog area in the Province.

Peatlands on the Highland Plateau were often dominated by *Scirpus* lawns in areas where ombrotrophic conditions exist, and often had co-dominant cover of *Carex* sp. or sedges and low ericaceous shrubs at sites which were more minertrophic. Tree cover in Highland bogs was limited to drainage tracts and peatland margins, and accounted for less than 6 percent of the total bog area. Tree cover tends to form in dense patches, and growth was often stunted.

Bog ponds and pools were found on all upland deposits surveyed. Usually the pools were randomly distributed on the deposit surface, but some occurred in well developed, eccentric or concentric patterns.

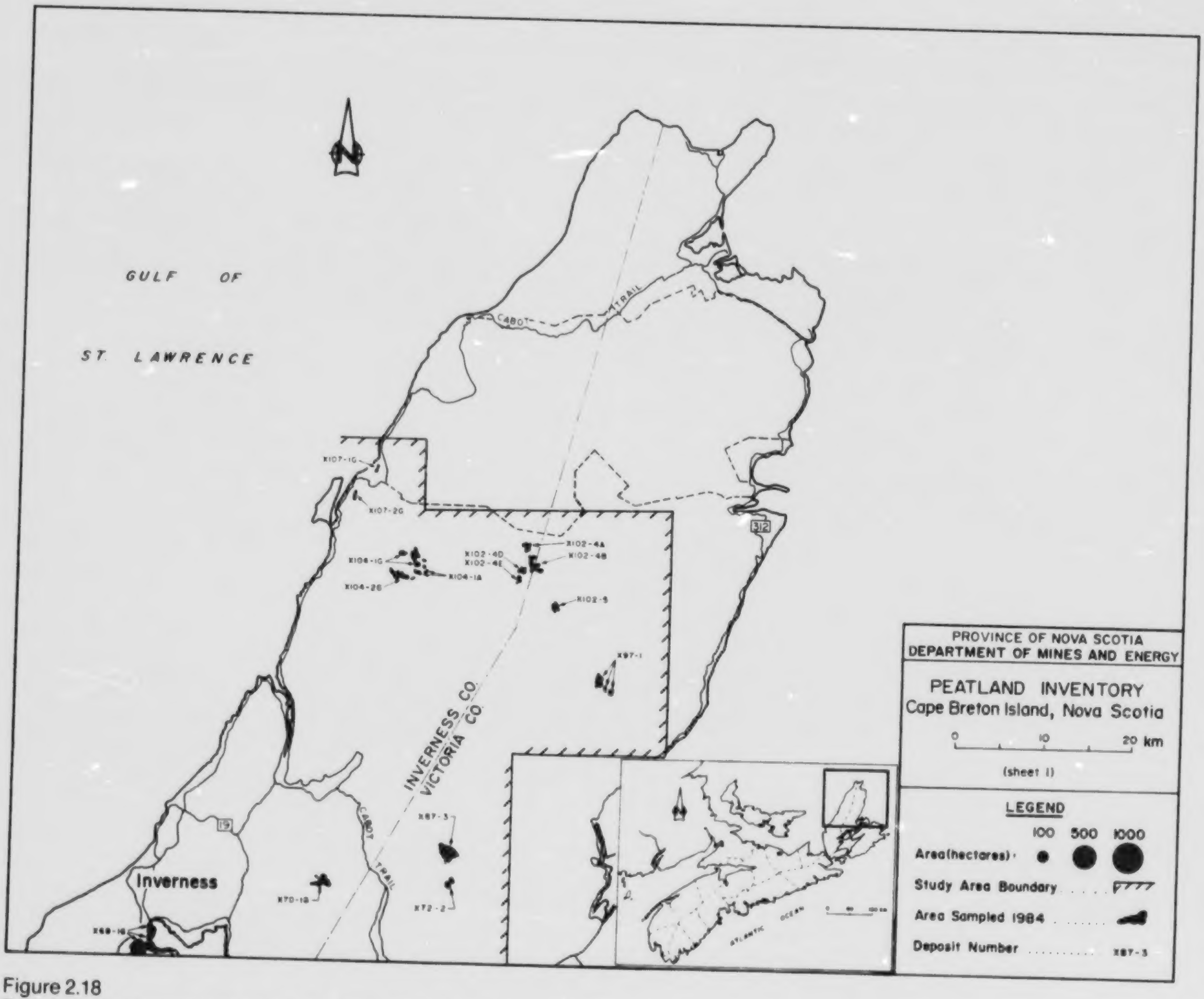

GULF OF
ST. LAWRENCE
CABOT TRAIL
312
X107-1G
X107-2G
X104-1G
X104-2G
X104-1A
X102-4D
X102-4E
X102-4A
X102-4B
X102-5
X97-1
INVERNESS CO.
VICTORIA CO.
19
Inverness
X68-1G
X70-1B
X87-3
X72-2
ATLANTIC OCEAN
PROVINCE OF NOVA SCOTIA
DEPARTMENT OF MINES AND ENERGY
PEATLAND INVENTORY
Cape Breton Island, Nova Scotia
0 10 20 km
(sheet 1)
LEGEND
Area(hectares) 100 500 1000
Study Area Boundary
Area Sampled 1984
Deposit Number X87-3

Figure 2.18
Peat deposits inventoried in northern Cape Breton Island.

Size and Distribution of Peatland Resource

Overview

Cape Breton Island has some 62,600 acres (25,100 ha) of peatland (Cann et al 1954b), of which 11,510 acres (4 660 ha) were surveyed by the inventory program. Most deposits not covered by the survey are small, inaccessible, or inside park or reserve boundaries.

The peat resources of the island are estimated to exceed 561 million cubic yards (429 Mm^3), of which 16 percent is fuel grade. The surveyed moss peat resources are 104 million cubic yards (80 Mm^3), of which 53 percent is in deposits greater than three feet (1 m) deep. The average depth of deposits in the region is 5.8 feet (1.7 m). Measured fuel peat resources are in the vicinity of 16.7 million cubic yards (12.8 Mm^3). However, no significant exploitable fuel peat reserves were found.

In the present inventory, forty peat deposits totalling 9,000 acres (3 640 ha) were surveyed along the eastern coastal plains and in the Sydney Basin. In these deposits, 4,750 acres (1 900 ha) were greater than three feet (1m) in depth, indicating a total resource of 75.3 million cubic yards (57.9 Mm^3).

Roughly 2,540 acres (1020 ha) of peatlands were surveyed on the Highland Plateau, of which 1,370 acres (550 ha) were greater than 3 feet (1 m) in depth. Resources in this area are significantly shallower than other resources surveyed in the Province. Roughly 17 million cubic yards (13 Mm^3) were surveyed, of which 14.4 million cubic yards (11 Mm^3) occurred in deposits greater than 3 feet (1 m) in depth (Table 2.8).

Peat found in the surveyed deposits of Cape Breton Island was predominantly *Sphagnum* based with minor sedge (*Carex*) and shrub constituents, a composition similar to peats found elsewhere in Nova Scotia. Seventy-nine percent of the resource was found to be poorly humified (less than H_4), and of the more humified peat, 70 percent had humifications less than H_6, indicating very fibrous peat.

The peat found in the bogs of the Highlands was primarily *Sphagnum* based (88 percent) with minor elements of sedge (deer grass and *Carex* spp.) and ericaceous shrubs. However the Highlands peat had considerably more *Scirpus* remnants than peat in bogs of other regions of the Island. The Eastern Plains and Sydney Basin peats are relatively pure *Sphagnum*. However their shrub content is higher than peat in the Highlands.

Very little fuel grade peat was encountered in the Highland deposits. Fuel peat was usually near the bottom of the profile, and was only 5 inches (0.14 m) thick. The surficial or moss grade peat averaged 6 feet (1.83 m), and was usually quite poorly humified, averaging between H_3–$_4$ ($H_{3\cdot1}$) and suitable for use as peat moss. Fuel or humified peat averaged $H_{4\cdot4}$.

The fuel peat deposits of the Eastern Plains and Sydney Basin were relatively thin, averaging 2 feet (0.62 m), but were still thicker than Highland Plateau deposits. The composition of plant material of these layers was similar for both areas-dominated by shrubby sedge-*Sphagnum* peats and shrub *Sphagnum* peats. This is different from other areas where pure *Sphagnum* peats tended to dominate. Humified peats also showed notably high contents of sedge, comparable to peats in Cumberland County, but much smaller than in Hants County peats. Humified peats in lowland areas of Cape Breton Island were similar in humification ($H_{5\cdot2}$) to fuel peats in Hants and Guysborough Counties.

Study Area	Deposit Number	Points Investigated	Area (ha)	Average Depth (m)		Average Humification		Volume (Mm³)		Million Tonnes		Million Bale Eq. Peat Moss Surficial	Million Barrels Eq. Light Oil
				Surficial	Humified	Surficial	Humified	Surficial	Humified	Surficial	Humified		
Highlands	X0701	66	63	1.64	0.06	2.9	4.9	1.04	0.04	0.15	0.01	3.12	0.02
	X0873	93	134	1.72	0.04	3.0	3.7	2.30	0.05	0.34	0.01	6.90	0.02
	X0971a	7	30	2.64	0.10	2.9	5.7	0.79	0.03	0.12	0.01	2.37	0.02
	X1024a	29	9	1.21	0.07	3.3	5.3	0.11	0.01	0.02	—	0.33	—
	X1024b	15	43	1.35	0.11	3.4	3.5	0.58	0.05	0.08	0.01	1.74	0.02
	X1024d	6	26	1.30	0.07	3.0	5.0	0.34	0.02	0.05	—	1.02	—
	X1025	34	62	2.37	0.58	3.1	4.2	1.47	0.36	0.21	0.07	4.41	0.12
	X1041	14	75	1.94	0.02	3.0	5.3	1.46	0.02	0.21	—	4.38	—
	Others	63	108	1.90	0.27	3.0	4.1	2.06	0.23	0.30	0.04	6.18	0.07
Lowlands	X0113	37	14	0.31	0.91	4.0	4.1	0.04	0.13	0.01	0.02	0.12	0.04
	X0171	75	71	2.19	0.33	3.1	5.2	1.55	0.23	0.23	0.04	4.65	0.07
	X0172	30	48	3.02	0.33	3.1	5.4	1.45	0.16	0.21	0.03	4.35	0.05
	X0173	11	39	2.83	0.36	3.4	5.3	1.10	0.14	0.16	0.03	3.30	0.05
	X0181	31	59	2.03	0.70	3.1	4.8	1.20	0.41	0.18	0.08	3.60	0.14
	X0191	103	166	2.17	0.58	3.1	5.3	3.60	0.95	0.53	0.18	10.80	0.32
	X0192	79	100	1.91	0.75	3.1	5.7	1.91	0.75	0.28	0.14	5.73	0.25
	X0193	35	45	2.58	0.38	3.2	5.2	1.16	0.17	0.17	0.03	3.48	0.05
	X0231	29	43	2.82	0.24	3.0	5.4	1.21	0.10	0.18	0.02	3.63	0.04
	X0232	14	61	2.13	1.20	3.0	5.7	1.30	0.73	0.19	0.14	3.90	0.25
	X0233	15	36	2.97	0.33	3.0	5.4	1.07	0.12	0.16	0.02	3.21	0.04
	X0234	23	78	2.89	0.31	3.3	6.1	2.25	0.24	0.33	0.05	6.75	0.09
	X0235	39	47	2.54	0.13	2.7	5.4	1.19	0.06	0.17	0.01	3.57	0.02
	X0251	27	42	2.20	0.39	3.3	5.9	0.92	0.17	0.13	0.03	2.76	0.05
	X0252	14	34	2.36	0.40	3.3	5.6	0.80	0.14	0.12	0.03	2.40	0.05
	X0261	44	56	1.80	0.54	3.2	5.5	1.01	0.30	0.15	0.06	3.03	0.11
	X0361	11	22	1.55	0.05	2.7	6.0	0.34	0.01	0.05	—	1.02	—
	X0441	45	73	3.15	0.28	3.0	4.9	2.26	0.20	0.33	0.04	6.78	0.07
	X0451	19	41	2.34	1.19	3.2	5.1	0.96	0.49	0.14	0.09	2.88	0.16
	X0491	46	80	1.32	0.90	3.6	5.4	1.05	0.72	0.15	0.14	3.15	0.25
	X0492	12	68	1.90	0.86	3.3	5.7	1.29	0.58	0.19	0.11	3.87	0.19
	X0531	28	48	2.80	0.63	2.9	6.1	1.39	0.30	0.20	0.06	4.17	0.11
	X0632	30	52	2.44	0.46	3.6	4.4	1.27	0.24	0.19	0.05	3.81	0.09
	X0681	61	88	0.39	1.57	3.6	4.5	0.34	1.38	0.05	0.26	1.02	0.46
	X0791	14	48	3.37	0.77	2.9	5.3	1.62	0.37	0.24	0.07	4.86	0.12
	X0793	22	35	3.42	0.40	2.9	6.0	1.20	0.14	0.18	0.03	3.60	0.05
	X0795	44	93	3.11	0.97	3.0	5.4	2.89	0.90	0.42	0.17	8.67	0.30
	X0796	2	57	4.85	0.40	2.8	5.5	2.76	0.23	0.40	0.04	8.28	0.07
	X0797	23	53	3.55	0.25	2.9	5.7	1.88	0.13	0.27	0.02	5.64	0.04
	Others	75	209	2.32	0.70	3.1	5.2	4.87	1.47	0.71	0.28	14.61	0.49

Table 2.8
The inventoried peat resources of Cape Breton Island
Values are given for areas where peat depth exceeds 3 feet (1m).

Major Deposits
A total of fifty-five deposits were investigated in the Cape Breton Island region. However only nine were identified as significant deposits. All nine deposits were selected for their peat moss potential. No significant fuel peat deposits were identified from the peatlands of this region. Eight of the moss grade resources selected were in the lowlands, primarily in Cape Breton and Richmond Counties, and one deposit was in the highland.

The most suitable moss grade resource, Sand Lake East Bog (X0796), had a surficial layer averaging 15.7 feet (4.8 m) in depth, one of the thickest in the province. In addition, this layer had notably lower humification than most areas, averaging $H_{2.8}$. The deposit was almost entirely moss peat with only 1.3 feet (0.40 m) on average of fuel peat.

Four deposits, East Bay Hills (X0441), Sand Lake (X0795), South Marconi (X0797), and Little Harbour Lake Bog (X0234), had significantly thinner moss grade peat layers which averaged between 9.48 and 11.64 feet (2.89 to 3.55 m) in depth. Surficial humifications of these deposits were slightly higher but generally similar to the Sand Lake East Bog (X0796).

Three other deposits selected in this area had average surficial thicknesses of 6-7 feet (2.03 to 2.19 m). These deposits, MacLeods Lake (X0171), Rory Neils Lake (X1081), and Rocky Brook bog (X0191), showed slightly higher average surficial humifications than the Sand Lake East Bog, but the existence of relatively poor humified fuel grade layers (averaging $H_{4.8}$ to $H_{5.3}$) may offer increased depth for peat moss harvesting in these deposits.

Indian Brook Bog (X1025), in the Cape Breton Highlands, was also identified as a very promising peat moss resource. This peatland had an average surficial depth layer of 7.77 feet (2.37 m), slightly thicker than the preceding three deposits. The surficial peats in this deposit had humifications of about $H_{3.2}$ and were underlain by a poorly humified fuel grade layer about 50 cm in thickness. Although this layer had an average humification of only $H_{4.2}$, it was of insufficient depth to offer any increase in harvestable moss peat.

2.3.7 Other Significant Peat Resources

A small number of deposits in other parts of Nova Scotia were surveyed in response to requests for information from the Department of Mines and Energy, and because of interest in providing information on deposits near potential markets.

Two groups of deposits in Halifax County, one near Port Dufferin and the other outside of Caribou Gold Mines, were surveyed for peat moss resources. In Kings County, four deposits were surveyed for fuel peat potential, as were six deposits in Pictou County (Figure 2.19).

Halifax County

The Halifax County deposits near the Caribou Gold Mines are considered as viable peat moss production sites because of substantial reserves and close proximity to a transportation route. The deposits (J2801G), near Sucker Lake, are raised, concentrically patterned, bogs, roughly 597 acres (240 ha) in size and containing some 8.1 million cubic yards (6.3 Mm³) of peat. The potentially mineable resource of peat moss is 7.1 million cubic yards (5.4 Mm³) (16 million bales of peat moss) (Table 2.9).

The Port Dufferin, Halifax Co., deposits totalled only 110 acres (44 ha) in 8 or 9 small deposits. These deposits are quite deep (12.5 feet, 3.2 m) but do not contain enough peat moss (640,000 cubic yards (490 000 m) [1.3 million bales of peat moss]) to warrant development (Table 2.9).

Kings County

Kings County deposits surveyed included the Auburn, Aylesford, Berwick (Annapolis Valley Peat Moss), and Baltzer Bogs, totalling roughly 1,500 acres (600 ha). The largest deposit, Berwick (I14-01G), was 734 acres (295 ha), of which 600 acres (240 ha) are currently under production for peat moss.A small part of this deposit (25 acres) is being used for vegetable production. There is an average of 5 feet (1.5 m) of peat moss remaining in this deposit, but in the centre of the bog moss peat depths still average over 10 feet (3 m). The bog also has a substantial fuel peat resource. Roughly 5 million cubic yards (3.8 Mm³) of fuel peat was found in areas of the bog where peat depth exceeded 3 feet (1 m). This represents about 770,000 tons (700,000 tonnes) of in situ fuel peat (at 50 percent moisture content). The potentially mineable fuel peat resources are shown in Table 2.9.

The Auburn Bog (I14-02) is a small deposit of 310 acres (124 ha), located in Auburn on the east side of Highway 101 immediately south of the railway tracks. A small area of the bog was once used for cranberry production, but for the most part the bog has remained undisturbed. Approximately 1.7 million cubic yards (1.3 Mm³) of peat, has been delineated in this deposit, of which 1.2 million cubic yards (0.95 Mm³) occurs in areas of the bog where peat is deeper than 3 feet (1 m).The surficial grade peat resource in areas of the bog where peat depth exceeds 3 feet (1 m), is 800,000 cubic yards (610 000m³), an equivalent of 1.5 million bales of peat moss. This deposit is a potential source of peat moss to complement the Berwick production.

At the time of the survey the Aylesford (I14-3) and the Baltzer (I16-1) bogs were used for agricultural crop production. The Aylesford bog (343 acres [139 ha]) has only 2 feet (0.6 m) of peat moss over 3 feet (1 m) of fuel peat, an insufficient quantity for development for fuel production at a commercial scale. The Baltzer deposit is almost entirely moss grade peat, but is too small for commercial moss peat production. This deposit has a total area of only 110 acres (44 ha), of which 64 acres (26 ha) had peat layers thicker than 3 feet (1 m).

Pictou County

Peat deposits surveyed in Pictou County amounted to 870 acres (349 ha) in less than a dozen deposits. All of the deposits were located in the River John, Pictou, and Stellarton areas, near fairly good transportation routes. The most notable deposit was the Mount William Bog, outside Westville on Highway 104. The bog, one of the smallest surveyed, was partially disturbed from early peat moss harvesting and drainage attempts. The surface of the bog had a dense shrub layer and fairly substantial tree cover. The bog had about 0.5 million cubic yards of peat moss resource of a total resource of 0.8 million cubic yards. Other bogs in the region held substantial peat resources (Table 2.9), but were heavily treed, making them fairly expensive to develop.

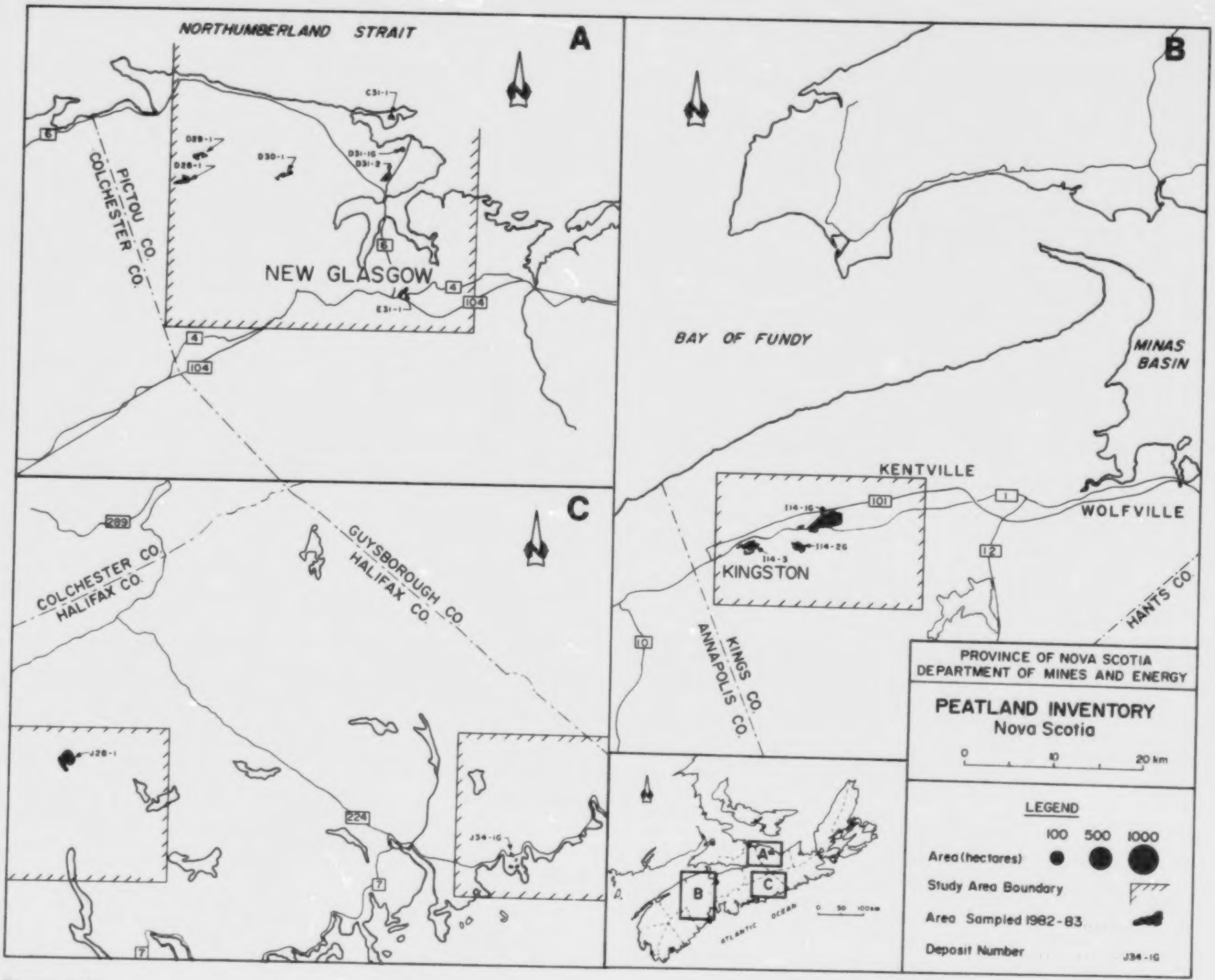

NORTHUMBERLAND STRAIT
A
PICTOU CO.
COLCHESTER CO.
NEW GLASGOW
C31-1
D28-1
D30-1
D31-1G
D31-2
E31-1
B
BAY OF FUNDY
MINAS BASIN
KENTVILLE
WOLFVILLE
KINGSTON
I14-1G
I14-2G
I14-3
KINGS CO.
ANNAPOLIS CO.
HANTS CO.
C
COLCHESTER CO.
HALIFAX CO.
GUYSBOROUGH CO.
HALIFAX CO.
J28-1
J34-1G
ATLANTIC OCEAN
PROVINCE OF NOVA SCOTIA
DEPARTMENT OF MINES AND ENERGY
PEATLAND INVENTORY
Nova Scotia
0
10
20 km
LEGEND
100
500
1000
Area (hectares)
Study Area Boundary
Area Sampled 1982-83
Deposit Number
J34-1G

Figure 2.19
Peat resources inventoried in areas of minor potential in Nova Scotia.

Study Area	Deposit Number	Points Investigated	Area (ha)	Average Depth (m)		Average Humification		Volume (Mm³)		Million Tonnes		Million Bale Eq. Peat Moss Surficial	Million Barrels Eq. Light Oil
				Surficial	Humified	Surficial	Humified	Surficial	Humified	Surficial	Humified		
Kings County	I1401G	54	295	1.48	1.75	3.4	5.4	3.19	3.76	0.47	0.71	9.57	1.24
	I1402	38	51	1.20	0.66	3.2	5.8	0.61	0.34	0.09	0.06	1.83	0.11
	I1403	14	54	0.59	1.00	2.9	5.7	0.32	0.54	0.05	0.10	0.96	0.18
	Other	3	26	1.57	0.27	4.0	4.6	0.41	0.07	0.06	0.01	1.23	0.02
Pictou County	D2801	1	38	0.50	0.80	3.4	5.0	0.19	0.30	0.03	0.06	0.57	0.11
	D3001	1	38	1.90	0.00	2.8	0.0	0.72	0.00	0.11	0.00	2.16	0.00
	D3102	2	40	2.50	0.00	4.0	0.0	1.00	0.00	0.15	0.00	3.0	0.00
	Other	6	66	2.56	0.73	3.4	4.9	1.69	0.19	0.25	0.04	5.07	0.07
Halifax County	J2801a	82	170	3.19	0.49	3.1	5.7	5.42	0.84	0.79	0.16	16.26	0.28
	Other	14	24	2.05	1.16	3.1	5.3	0.39	0.28	0.07	0.01	1.47	0.02

Table 2.9
The inventoried Peat Resources of Kings, Pictou and Halifax Counties.
Values are given for areas where peat depth exceeds 3 feet (1m).

2.4 Physical and Chemical Characteristics of Nova Scotia Peat

2.4.1 Introduction

The inventory program included the gathering of qualitative data on physical characteristics of peat for 267 peatland deposits during five years of field investigations (1980-1985). In addition, in the latter part of each field season, representative sites on the major deposits were sampled for quantitative analysis of chemical and physical characteristics of the peat (Figure 2.12).

The samples, comprising a total of 1,010 feet (308 m) of peat core retrieved from 69 sites province-wide, were subjected to trace element analysis and proximate analysis-heat value, bulk density, sulfur content, ash content, and moisture content-which are of value when assessing quality of fuel peat. Trace element analysis provided additional information that may have further applications in the study of the peat resource. i.e. geochemical prospecting.

The bulk of the quantitative sampling took place in southwestern Nova Scotia, where 577.4 feet (176 m) of core was analysed at 44 separate locations (Table 2.10). Other areas sampled include Cumberland and Hants Counties and the lowland areas of Cape Breton Island. Due to poor access and lack of fuel grade peat, peatlands in Guysborough County and the Cape Breton Highlands were not been sampled for laboratory analysis.

All parts of the physical and chemical analysis, with the exception of trace element analysis, were conducted by the Canada Centre for Mineral and Energy Technology (CANMET), Coal Research Laboratories, in Sydney, Nova Scotia. Trace element analysis for 24 elements was carried out at Chemex Labs, North Vancouver, British Columbia.

Study Area	Number of Samples Taken	Cumulative Depth Analyzed
SW Nova Scotia		
Inland	4	139.4
Coastal	19	775.0
Lake Rossignol	21	845.5
Hants County	6	419.0
Cumberland County	8	379.9
Guysborough County	0	0
Cape Breton Island		
Lowland	11	524.0
Highland	0	0
Totals	69	3 083

Table 2.10
Summary of peat samples taken for laboratory analysis

2.4.2 Methodology

Field Sampling
At each of the sites selected, peat core was collected using a MacAulay Sampler (Figure 2.6). This type of sampler takes a duplicate set of large, clean, samples of undisturbed peat strata.

The sampling procedure was carried out using two bore holes. To ensure that successive samples at the same site remained undisturbed by the retrieval of samples from directly above, samples from successive depths came from alternate holes. Samples were collected in this manner until the bottom of the deposit or an impervious layer was reached.

Each section of core was subdivided on the basis of its botanical composition and degree of humification. The lengths of these subdivisions, and their respective depths in the hole, were estimated to the nearest millimetre and recorded. One of the duplicate core sections was studied to categorize and record the actual composition and humification of each of the subdivisions chosen. All samples were then sealed in plastic bags and boxed for shipment.

Preliminary Analysis
Peat samples were tested to determine wet and dry bulk densities and percent of free moisture.

Wet Bulk Density
Laboratory volume determination for peat samples proved cumbersome and inaccurate. As a result, volumes of peat samples taken in 1981 and succeeding years were determined in the field by careful measurement of sample dimensions. The samples were then weighed in the lab to provide wet bulk density data. This method was found to be extremely practical, allowing for quick and consistent field volume determinations while the peat was still in a relatively undisturbed state.

Dry Bulk Densities
To determine dry bulk densities, air dried samples were crushed and volume measured using a graduated cylinder. Volume and the mass of the crushed sample were then used to calculate the air dried bulk density.

Percent Free Moisture
Percent free moisture is the percentage of the mass of a sample attributed to moisture which is not chemically bound in the peat. Peat samples were air dried for approximately three weeks at 25°C and 14 percent relative humidity. Percent free moisture was derived by dividing the loss in mass on air drying by the original mass of the sample as received.

Proximate Analysis
Variables such as percentage of ash, volatile matter, fixed carbon, and chemically bound moisture, were also determined. Values are expressed as a percentage loss of the air dried mass.

Bound moisture

The percentage of bound moisture in the peat sample was determined and expressed as the percentage of the remaining mass after oven drying. The air dried sample was pulverized to 60 Mesh and then dried in an oven at 107°C to release any remaining moisture in the sample. It is important to realize that this value pertains to the air dried mass and not the original mass of the peat sample. Percentage of bound and free moisture were then used to determine the actual total moisture of the sample as received.

Volatile Matter

After bound moisture determination, the same sample (now free of moisture) was placed in a closed crucible and heated to 950°C for a suitable period of time to drive off all volatile matter. The loss in mass was evaluated as percentage of volatile matter.

Fixed Carbon

After volatile matter was removed, the crucible was opened to allow oxidation to take place while the sample was ashed at 750°C. The resulting loss in mass is attributed to the content of fixed carbon remaining in the peat sample.

Ash Content

The remaining mass after oxidation at 750°C was then expressed as percentage ash. Ashing at 750°C is referred to as high temperature ashing, and best represents furnace conditions encountered when using peat as a fuel. When samples are ashed for trace element analysis, lower temperatures are used to retain less temperature resistant minerals.

Chemical Analysis

Two remaining chemical determinations carried out were for sulphur content and for heat value of the peat samples.

Sulphur

Sulphur content was determined by two methods. Pulverized, air dried samples, prepared in 1980, were analysed using a Leco Titrator during a high temperature combustion at 1315°C. Subsequently samples were analyzed using a LECO 5032 infrared detection system during high temperature combustions at 1370°F. Values evaluated are expressed as a percent sulfur on an air dried basis.

Calorific Value

The amount of energy stored in peat in the form of volatiles and fixed carbon was obtained using an Oxygen Bomb calorimeter. A small portion 0.0176 ounces (0.5 grams) of the pulverized sample was placed in the calorimeter and ignited at 420 psi (2896 KPa) oxygen. Heat generated in the combustion was then recorded as a heat value for the sample.

Trace Element Analysis

Trace element analysis, performed at Chemex Labs in Vancouver, examined 24 elements in selected intervals of peat core representative of specific types of peats, as well as in composite samples for individual peat deposits. Trace elements were analysed by Inductively Coupled Plasma-Atomic Emission Spectrometry (ICP-AES) and Atomic Absorbtion spectrometry. All results were obtained by ICP-AES with the exception of silver, which was determined by Atomic Absorption spectrometry (Table 2.11).

All samples used for trace element determinations were ashed at 550°C prior to analysis to retain mineral content.

	Element	Detection Limits	
1.	Molybdenum	1.0	ppm
2.	Tungsten	10.0	ppm
3.	Zinc	1.0	ppm
4.	Prosphorus	10.0	ppm
5.	Lead	3.0	ppm
6.	Bismuth	2.0	ppm
7.	Cadmium	0.5	ppm
8.	Cobalt	1.0	ppm
9.	Nickle	1.0	ppm
10.	Barium	1.0	ppm
11.	Iron	0.01	%
12.	Manganese	1.0	ppm
13.	Chromium	1.0	ppm
14.	Magnesium	0.01	%
15.	Vanadium	1.0	ppm
16.	Aluminum	0.01	%
17.	Beryllium	0.5	ppm
18.	Calcium	0.01	%
19.	Copper	1.0	ppm
20.	Silver	1.0	ppm
21.	Titanium	0.001	%
22.	Strontium	1.0	ppm
23.	Sodium	0.01	%
24.	Potassium	0.01	%

Table 2.11
Trace elements analysed and detection limits

Data Treatment and Presentation

Only the results of analyses carried out at CANMET labs in Sydney, Nova Scotia (most of the analyses) will be discussed in this section. Selected samples from those tested in Sydney were ashed and subjected to Trace Element Analysis. Results of the Trace Element work will not be discussed in this report but do exist as part of the inventory data base.

All laboratory analysis data was transferred onto the computer system at Dalhousie University. The data file created was then sorted in various formats to decide at what level of sorting the data could be most adequately summarized.

Sphagnum Peat Analysis	Bound Moisture %	Ash %	Volatile Matter %	Fixed Carbon %	Sulphur %	Heat Value (BTU/lb)	Dry Bulk Density (g/ml)	Wet Bulk Density (g/ml)	Total Moisture %	Air Dry Mositure %
Humifications 1 and 2										
Southwestern Nova Scotia	9.07	2.02	65.35	23.72	0.19	7970	0.750	0.071	94.29	93.72
Hants County	7.37	1.08	68.42	23.13	0.12	N.A.	0.713	0.071	93.91	93.42
Cumberland County	8.20	0.85	67.44	23.51	0.10	N.A.	0.876	0.128	93.93	93.39
Cape Breton Lowlands	9.99	1.35	64.59	24.07	0.23	7793	0.858	0.073	93.25	92.50
Provincial Average	8.93	1.56	65.91	23.69	0.17	7955	0.794	0.082	93.99	93.39
Standard deviation	1.18	1.70	2.39	1.36	0.09	228	0.160	0.097	1.54	1.69
Samples analyzed	92	85	85	85	85	12	82	88	92	92
Humifications 3 and 4										
Southwestern Nova Scotia	8.74	2.13	62.55	26.64	0.22	8326	0.931	0.155	94.81	92.46
Hants County	7.52	1.56	64.81	26.11	0.12	7720	0.891	0.100	93.05	92.48
Cumberland County	8.00	0.94	64.83	26.23	0.10	8470	0.952	0.173	93.01	92.40
Cape Breton Lowlands	10.03	1.67	61.78	26.51	0.27	8199	0.99	0.162	92.95	92.17
Provincial Average	8.72	1.79	63.04	26.48	0.20	8253	0.942	0.152	94.00	92.40
Standard Deviation	1.20	4.13	3.48	1.93	0.11	503	0.149	0.085	21.79	1.97
Samples analyzed	534	505	505	505	505	102	534	534	534	534
Humifications 5 and 6										
Southwestern Nova Scotia	8.50	2.42	60.56	28.58	0.29	8870	0.977	0.293	90.98	90.14
Hants County	7.55	2.82	61.12	27.51	0.19	8388	0.881	0.146	91.17	90.44
Cumberland County	7.73	1.43	62.62	28.22	0.12	8680	0.908	0.311	91.04	90.29
Cape Breton Lowlands	9.86	6.40	57.20	26.53	0.47	8278	1.040	0.320	90.36	89.34
Provincial Average	8.64	2.83	60.37	28.18	0.31	8728	0.977	0.288	90.97	90.11
Standard Deviation	1.19	3.56	3.00	1.79	0.18	583	0.167	0.099	1.60	1.75
Samples analyzed	249	227	227	227	227	85	249	249	249	249
Humifications 7 and 8										
Southwestern Nova Scotia	8.29	3.49	59.56	28.65	0.40	9264	0.983	0.415	89.59	88.62
Hants County	6.79	3.65	61.30	28.27	0.15	8361	0.777	0.158	88.56	87.54
Cumberland County	7.48	4.74	60.48	27.30	0.19	9026	1.029	0.431	89.30	88.44
Cape Breton Lowlands	9.77	11.76	53.45	25.02	0.45	8768	1.018	0.430	87.27	85.89
Provincial Average	8.27	4.82	59.03	27.89	0.35	9103	0.991	0.412	89.24	88.25
Standard deviation	2.07	6.59	4.58	2.94	0.17	446	0.128	0.118	2.16	2.45
Samples analyzed	105	94	94	94	94	43	92	93	105	105
Humifications 9 and 10	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.

Table 2.12
Physical and chemical characteristics of Nova Scotia *Sphagnum* based peats.

Data presented here has been divided according to two basic peat types, *Sphagnum* dominated and sedge dominated peats. These have been further broken into five humification ranges containing H_{1-2}, H_{3-4}, H_{5-6}, H_{7-8}, and H_{9-10}.

After the data was sorted, a simple report writing program was created to determine numbers of samples involved and mean and standard deviations for each set of test values. The results of these calculations are presented in Tables 2.12 and 2.13. Some of the less common peat types found in the province were poorly represented in these determinations. Sedge peats with humifications of H_1 or H_2 were uncommon and are not represented here. Also, although peats with humifications of H_9 and H_{10} have been found in the province, none of the sites chosen for laboratory sampling contained them.

The number of samples included in different tests varied significantly, primarily due to limited representation for specific peat types as mentioned above, but also because more complicated and costly tests usually were restricted to more important peat lenses in the deposit profiles. As a result, while as many as 500 samples were evaluated for some parameters, as little as four were analysed for others. The number of analyses for a given parameter should be considered when evaluating results for some peat types presented here.

Only five of the parameters presented in Tables 2.12 and 2.13 have been graphed, and for the purposes of this report only general aspects of the results will be discussed.

2.4.3 Discussion

Ash Content

Sphagnum and sedge based peats differ substantially in mean ash content (Tables 2.12 and 2.13). The range in ash content for *Sphagnum* peats was from 1.5 to 4.8 percent, while for sedge peats it was 6.4 to 11.2 percent. In both peats, ash content rose sharply with increases in humification. Ash contents in peats from Southwestern Nova Scotia were slightly higher than other areas. Cumberland County peats had typically lower ash values. The variability of sedge peat ash content was much greater than in *Sphagnum* based peats, as reflected in the standard deviations plotted on Figure 2.20.

Sulphur Content

The mean sulphur contents for *Sphagnum* and sedge peats, and the respective standard deviations were similar (Tables 2.12 and 2.13; Figure 2.20). The range of mean sulphur content for both types was only 0.22 percent (0.17 to 0.39). The sulphur content in sedge peats, however, appeared to be more consistent as it was not influenced significantly by changes in humification of the peat. In the *Sphagnum* peats there tended to be more variation, with sulphur content increasing gradually with humification. Peats in Cumberland County typically had lower mean sulphur values than other areas, as illustrated by Figure 2.20. Cape Breton and Southwestern Nova Scotia peats also had lower sulphur content.

The average sulphur content of "fuel grade" peats in the province was only 0.31 percent. This was only 7 percent of that of typical Cape Breton Coal, 10 percent of heavy fuel oil, and roughly equivalent to that of light fuel oil.

Volatile Matter

The content of volatile matter in both *Sphagnum* and sedge peats appear to decrease notably with increases in humification (Figure 2.21). This trend was most evident in *Sphagnum* peats. Typically sedge peats were roughly 6 percent lower than *Sphagnum* for all the humification ranges. *Sphagnum* peats contained from 59 to 66 percent volatiles (Table 2.12), while sedge peats contained from 56 to 60 percent volatiles (Table 2.13). As indicated by the standard deviations plotted on Figure 2.21, sedge peat showed about twice as much variability in volatile content as *Sphagnum* peat. Some of this variation was probably caused by the limited number of sedge samples analyzed. Volatile matter contents were lowest in Cape Breton County *Sphagnum* peats and highest in Cumberland and Hants County peats.

Fixed Carbon Content

Sphagnum peats showed sharp increases in fixed carbon content with rising humification. In contrast, sedge peats appeared to have high carbon contents at low humifications, and carbon content decreased as humification increased (Figure 2.21). Fixed carbon contents of both peat types were between 23 and 29 percent (Tables 2.12 and 2.13). Low values were observed typically in Cumberland County peat samples, and high fixed carbon contents were found in peats from southwestern Nova Scotia. The sedge peat fixed carbon values in samples were almost twice as variable as *Sphagnum* peat samples.

Air Dried Bulk Density

Density values showed a similar relationship to humification as for fixed carbon values (Figure 2.22). *Sphagnum* peats showed increases in bulk densities with higher humifications while sedge peat densities decreased at roughly the same rate. All mean bulk density values were between 0.75 and 1.05 g/ml, and both *Sphagnum* and sedge had approximately the same variability in values (Tables 2.12 and 2.13; Figure 2.22).

Hants County peats generally were found to have lower mean bulk densities than other areas. Highest values were recorded for Cape Breton Island peatlands.

Heat Value

A comparatively small number of samples were tested for heat value. These were samples of special interest, usually taken from fuel grade peat lenses.

Mean heat values for *Sphagnum* based peats ranged from 7955 to 9103 BTU per pound (4418-5056 Kcal/kg). Heat values changed considerably with the humification of the peat (Figure 2.22). Although few analyses were available for sedge peats, the plotted means indicate that the variability may be smaller than for *Sphagnum* peats (Figure 2.22). Sedge peat values changed only slightly with differences in humification, averaging about 8775 Btu per pound (4874 Kcal/Kg), near the middle of the range for *Sphagnum* peats. Again, although little sedge data was available, standard deviations plotted indicate a comparable dispersion for *Sphagnum* and sedge heat values.

Peat from Southwestern Nova Scotia, for which considerable data was available, showed the highest heat values, while low values were recorded for Hants County peats.

Sphagnum Peat Analysis	Bound Moisture %	Ash %	Volatile Matter %	Fixed Carbon %	Sulphur %	Heat Value (BTU/lb)	Dry Bulk Density (g/ml)	Wet Bulk Density (g/ml)	Total Moisture %	Air Dry Mosíture %
Humifications 1 and 2	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Humifications 3 and 4										
Southwestern Nova Scotia	7.94	7.52	57.73	26.95	0.45	8826	1.034	0.244	91.03	90.27
Hants County	7.27	4.23	62.23	26.27	0.20	N.A.	1.175	0.133	91.58	90.92
Cumberland County	7.17	2.88	63.87	26.09	0.18	8978	0.840	0.242	91.23	90.56
Cape Breton Lowlands	9.53	3.96	59.70	26.82	0.45	8060	1.035	0.263	90.43	89.42
Nova Scotia average	7.83	6.43	59.10	26.76	0.39	8758	1.027	0.234	91.07	90.33
Standard deviation	1.10	9.89	6.38	3.67	.18	616	.324	0.094	2.03	2.12
Samples analyzed	60	54	54	54	54	9	52	54	60	60
Humifications 5 and 6										
Southwestern Nova Scotia	7.21	7.99	58.36	26.44	0.53	8625	0.944	0.182	91.01	90.30
Hants County	6.85	7.20	59.78	26.17	0.32	N.A.	0.570	0.152	90.51	89.82
Cumberland County	7.28	8.20	59.90	24.62	0.25	8770	0.979	0.342	90.99	90.29
Cape Breton Lowlands	9.61	5.55	58.66	26.19	0.44	8904	1.034	0.327	90.88	89.91
Nova Scotia average	7.58	9.85	57.42	25.15	0.40	8801	0.945	0.262	90.09	89.34
Standard deviation	1.56	15.41	9.96	4.86	0.17	141	0.162	0.129	4.58	4.69
Samples analyzed	26	26	26	26	26	4	23	26	24	24
Humifications 7 and 8										
Southwestern Nova Scotia	8.31	8.33	57.78	25.58	0.34	N.A.	0.920	0.404	89.48	88.51
Hants County	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Cumberland County	7.42	16.15	54.35	22.08	0.34	N.A.	0.930	0.395	91.94	91.30
Cape Breton Lowlands	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Nova Scotia average	7.98	11.26	56.49	24.27	0.34	N.A.	0.924	0.401	90.40	89.56
Standard deviation	1.02	10.25	6.85	3.89	0.02	N.A.	0.110	0.110	2.33	2.60
Samples analyzed	8	8	8	8	8	N.A.	8	8	8	8
Humifications 9 and 10	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.

Table 2.13
Physical and chemical characteristics of Nova Scotia sedge based peats.

2.4.4 Conclusions

As already noted, the accuracy of results for various peat types will vary depending on the number of representative samples which have been analyzed. This is especially true of the sedge peat analysis, and any inferences made should be considered in this light.

All the analyses conducted on Nova Scotia peat have indicated that *Sphagnum* based peats, regardless of degree of humification, have less ash and sulfur, more volatiles and fixed carbon, and larger heat values than sedge peats.

Sphagnum peats were less variable in many characteristics than sedge peats. This feature may be related to greater fluctuations present in the depositional environment of sedge peats, and to the relatively small sedge peat sample size.

Sphagnum peats show significant differences in heat value, ash content, sulphur content, fixed carbon ratio, and other variables depending on their state of humification. Generally the higher the humification value, the greater the heat value, ash content, and fixed carbon. The low sulphur content (less than 0.5%) of peat, and its other physical characteristics, make it an excellent source of energy for use in many applications in Nova Scotia.

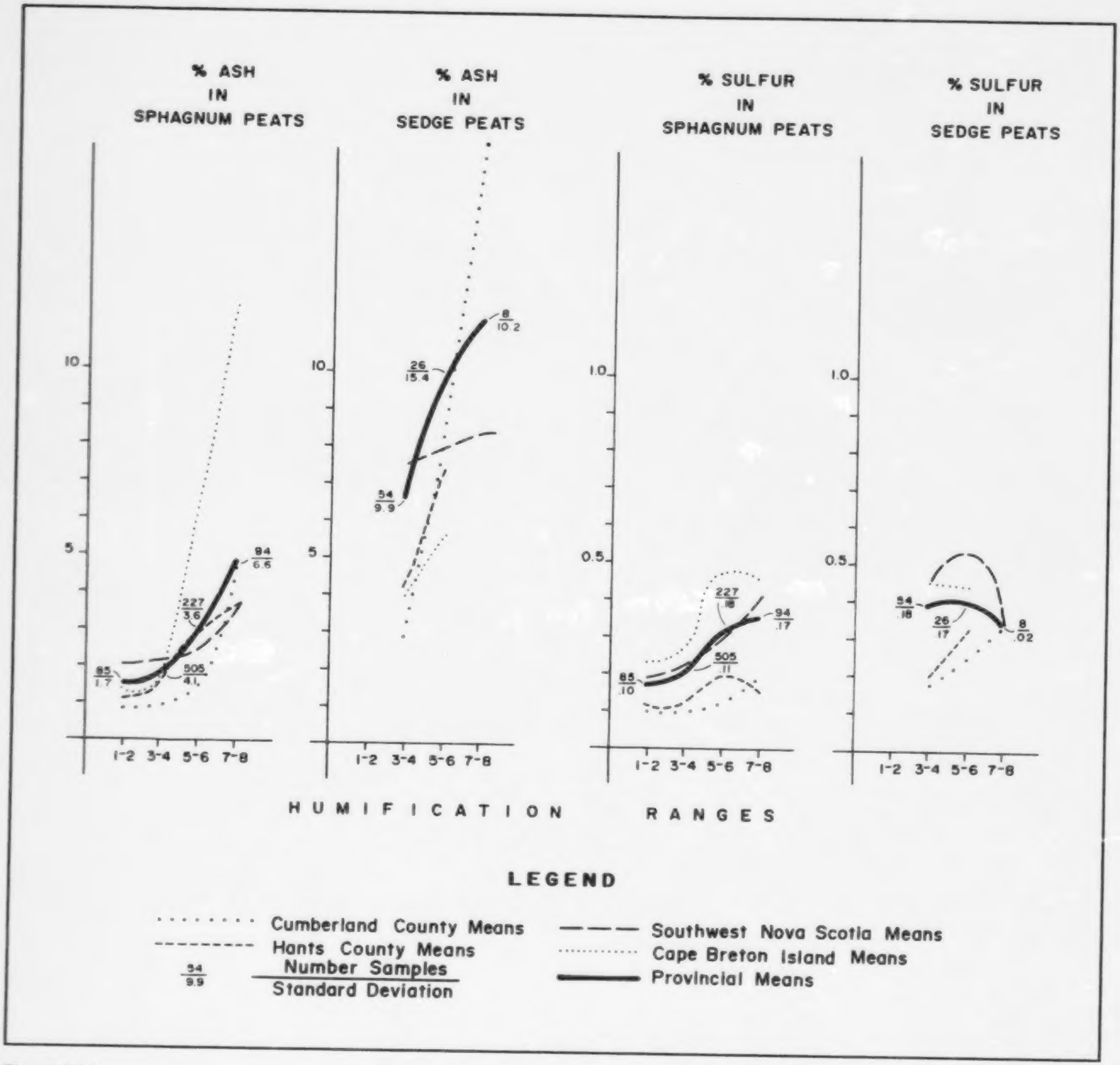


Figure 2.20
Mean ash and sulfur content of Nova Scotia peats.

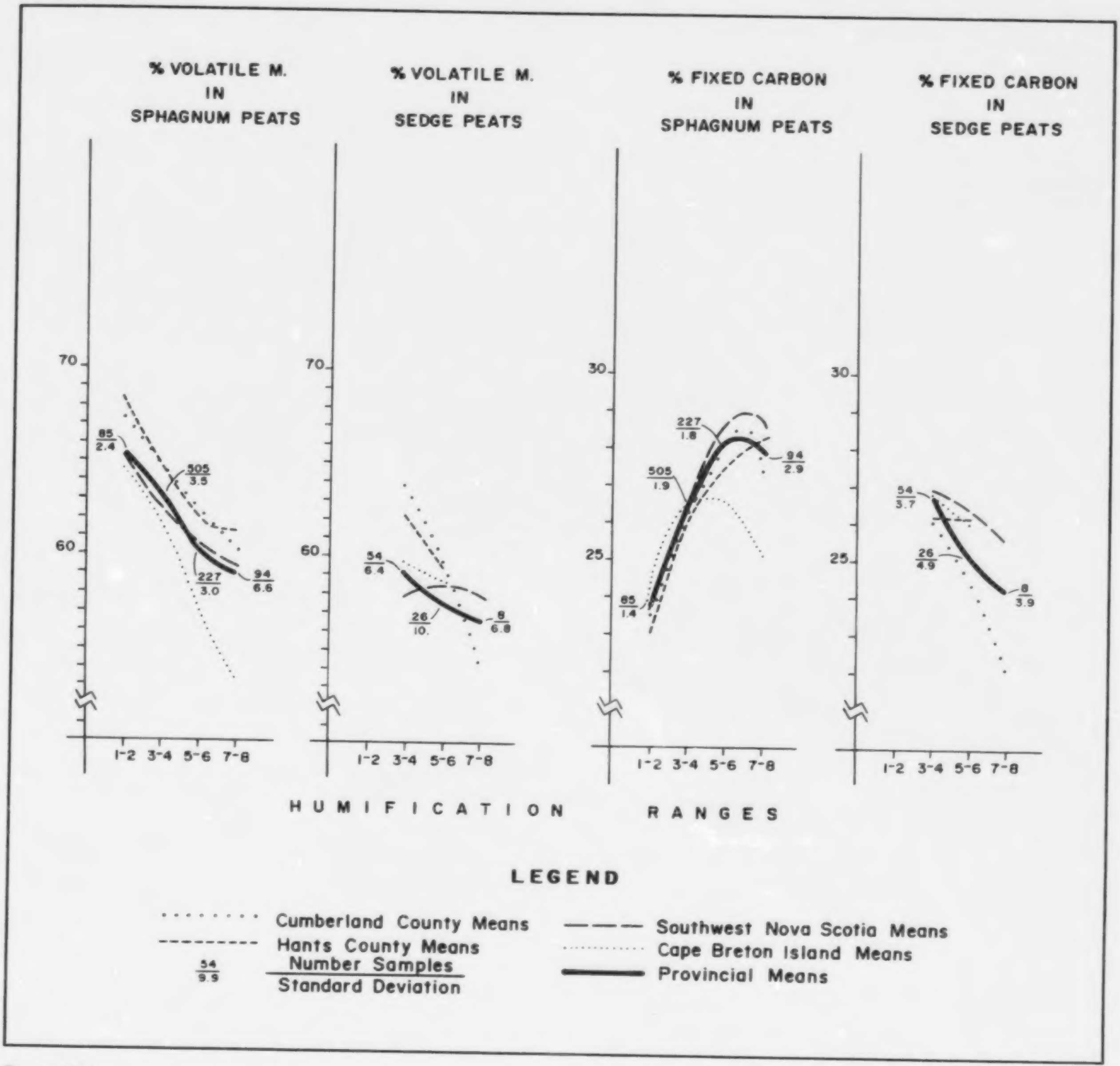


Figure 2.21
Mean content of volatiles and fixed carbon in Nova Scotia peats.

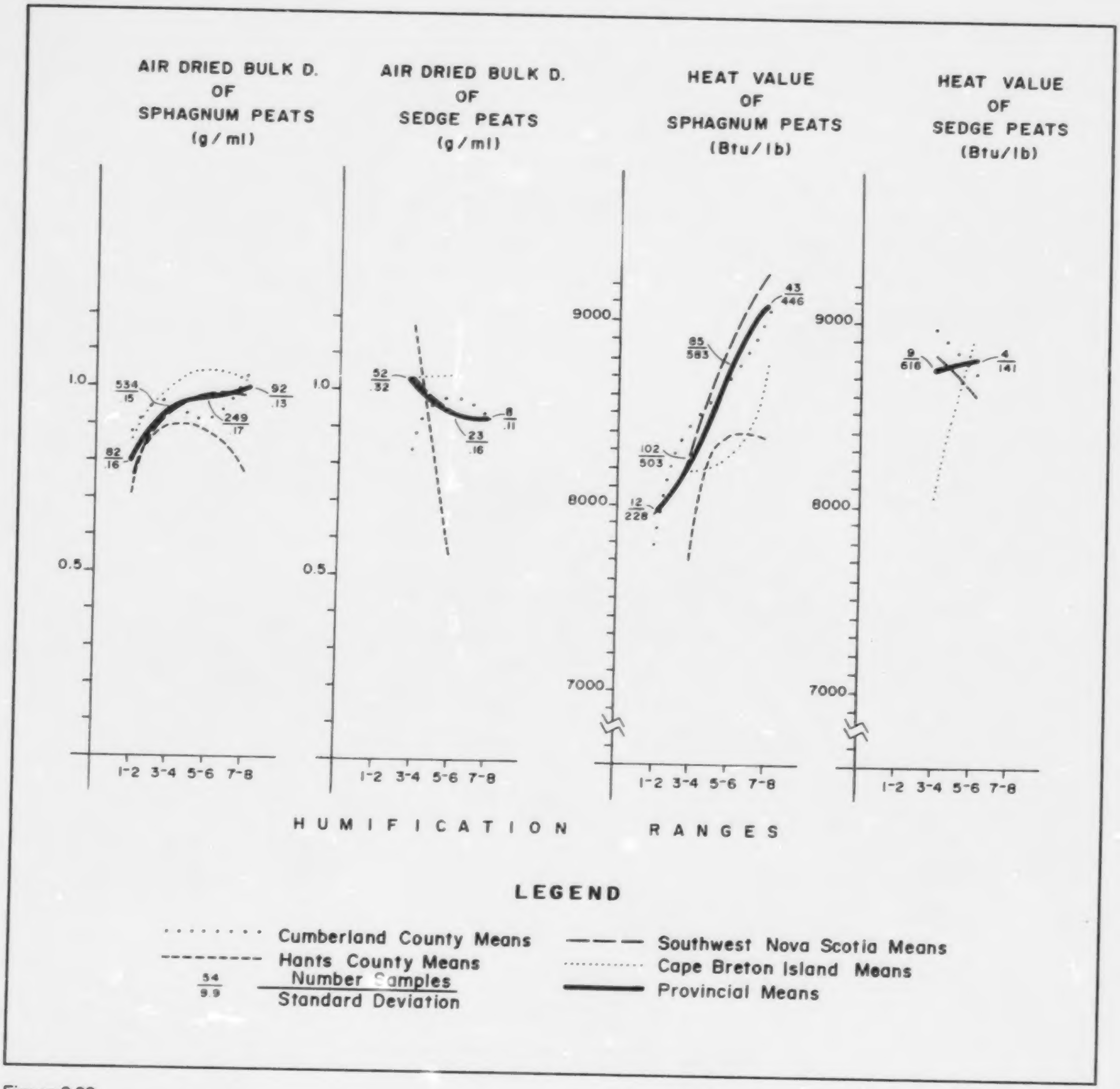


Figure 2.22
Mean air dried bulk density and heat value of Nova Scotia peats.

2.5 The Distribution and Classification of Peatlands in Nova Scotia

2.5.1 Introduction

To provide a more comprehensive assessment of Nova scotia's peatland resources, a remote-sensing and digital mapping project was undertaken. This aspect of the program complemented field surveys, providing a series of map sheets displaying the distribution, size, and type of all peatlands found in Nova Scotia.

The peatland resource of Nova Scotia has been depicted as "organic soil" or simply as "peat" on the series of soil maps available through the Nova Scotia Department of Agriculture and Marketing. These maps, however, do not provide an overview of resource distribution or provide a detailed biophysical classification of these areas that would be useful in resource assessment. A set of three maps, covering the Province at a scale of 1:250,000, has been created to provide additional resource information on all peatlands, including those directly surveyed as a result of field investigations. The resulting maps are available through the NSDME library.

The maps provide information on:

— relative size and distribution of the significant peatlands in the province.
— a simple biophysical classification of peatland type and relief.
— deposits inventoried by the Department of Mines and Energy from 1980-1985.
— summary tables on a provincial and individual map sheet basis including:
  total area of bog, fen and swamp; total area raised, sloping and flat peatlands; total area of inventoried deposits in each class; and total peatland resources.

2.5.2 Remote Sensing and Photo Interpretation

Peatland areas classified throughout the province were interpreted andclassified on 1:63,360 colour infared imagery following some very basic guidelines:

— Only peatlands larger than 25 acres (10 ha) and singly or cumulatively representing 30 percent of the land surface were mapped;
— Each peatland area classified was coded to reflect the dominant form determined by airphoto signature (color, texture, pattern, site, association); and
— Peatlands smaller than 25 acres (10 ha), when directly associated with other larger peatlands, were coded individually and grouped with the dominant peatlant.

Each deposit or individual peatland form was classified as either a bog, fen, or swamp, depending on the following criteria:

Bogs: raised, flat, or slopping surfaces indicating peatlands typically comprised of *Sphagnum* moss and ericaceous surface vegetation (predominantly ombrogenic peatlands).
Fens: flat or sloping surface indicating more nutrient rich peatland, dominated by graminoid plants. This category included strongly minerorophic bogs.
Swamps: densely treed, flat or sloping, usually shallow, peatlands, often occurring at peatland margins, or in drainage tracts and confined basins.

Concentric and eccentric pool-hummock formations, random ponding, and vegetation patterns were used to provide an indication of biophysical type within each of the peatland forms. The classification system used is presented in a key form in Figure 2.23. Each classified peatland was delineated using one or more hand drawn "polygons".

Interpreted information on the aerial photographs was then transferred to 1:125 000 provincial map book series sheets using a Kargyle Reflecting Projector. These sheets were then taken to Maritime Resource Management Services (MRMS) in Amherst for digitizing, to create a data base from which the final maps were produced.

The digitizing project resulted in two sets of forty-five, 1:125,000 mapsheet overlays which showed the relative size, distribution, and peatland type. A number, which could be referenced to a surface area value, and the biophysical classification code, was assigned to each polygon.

To generate a useful set of 1:250,000 scale maps it was necessary to reduce the number of parameters to be displayed from 14 to 7. The final set of maps display, bogs, fens, and swamps and their associated relief, and highlight deposits surveyed by the 1980-1985 inventory program.

BOG	*RAISED*	unpatterned	A
		concentric	B
		eccentric	C
	SLOPING	unpatterned	D
		eccentric	E
	FLAT	unpatterned	F
		eccentric	G
FEN	*SLOPING*	unpatterned	H
		eccentric	I
	FLAT	unpatterned	J
		eccentric	K
SWAMP	*FLAT*	unpatterned	L
OTHER			M

Figure 2.23
Classification key for Nova Scotia peatlands.

2.5.3 Resource Summary

Distribution
The mapping project mapped and tabulated deposits that fit the criteria set out earlier in this section. The project tabulated 433,372 acres (175 386 ha) of peatland in Nova Scotia, of which 318,646 acres (128 956 ha) are bogs, 58,855 acres (23 820 ha) are fens or highly minertrophic bogs, 48,406 acres (19 590 ha) are swamp, and 7,465 acres (3 020 ha) are unclassified peatlands. Roughly 74 percent of the Province's peat resources lie in the western end of the province as can be seen from Map Sheet 1. The remainder is split evenly in the eastern mainland and Cape Breton Island.

Biophysical Character
Most peatlands in Nova Scotia tended to be relatively flat or raised, with very few sloping bogs. The Cape Breton Highlands and the upland regions of Guysborough and Cape Breton had a relatively high percentage of sloping and blanket bogs.

The raised deposits of southwestern Nova Scotia tended to be gently raised except for extreme southwestern coastal areas, where there were a large number of "raised plateau bogs". Patterned bogs were not very common in this region. However deposits in the cooler climatic zones of western Nova Scotia were often characterized by either concentric rings and/or random ponding.

The Cape Breton Highlands had a number of deposits whose biophysical type was characteristic of more northerly latitudes. Ladder bogs, blanket bogs, and ribbed sloping bogs, were found more often than true raised bogs.

"Fens" and "minerotrophic bogs" were found throughout Nova Scotia. They usually were found in shallow open ended basins, and often were associated with streams or bodies of water. These peatlands were generally quite small. However large minerotrophic bogs occurred in the southwestern coastal plain near the Barrington-Port Saxon area and in the Missaguash Marsh area near Amherst.

Swamps were also found throughout Nova Scotia, with a notable exception the Cape Breton Highlands. These small peatlands were usually found associated with other peat deposits or in shallow poorly drained basins. The highest frequency of swamps was most notably throughout southern Nova Scotia, particularly in the Yarmouth, Digby, and Annapolis areas.

The information provided by these maps is meant to provide a visual overview and assessment of the distribution of peatland types and extent of the resources in each region of the Province. Not all peatlands in the province are shown on these maps but sufficient detail exists to allow for a first pass assessment of the resource potential in a given area.

2.6 The Effect of Climatic Factors on Potential Peat Production Rates in Nova Scotia

2.6.1 Introduction

Peat in its natural state is about 90 percent water by weight. To be economically harvested or marketed, peat should have a moisture content (M.C.) between 40 and 50 percent. In simple terms, for every tonne of in situ peat, 800 kilograms of water must be removed to produce 200 kilograms of peat at 50 percent M.C. or less. Most of this water is removed by drying the peat, rather than by draining the bog or peat deposit. The rate at which water can be evaporated from the surface of the peat deposit thus determines how much material can be harvested in a given season. Figure 2.24 demonstrates the relative importance of evaporation and ditching in drying the peat.

Current harvesting technologies associated with horticultural and fuel peat industries rely totally on favourable climatic conditions for drying peat. In the future, research into wet harvesting technologies may relieve some of the dependence on good drying conditions, but any decision to develop a peat industry today must involve careful consideration of climatic conditions in the vicinity of the deposit.

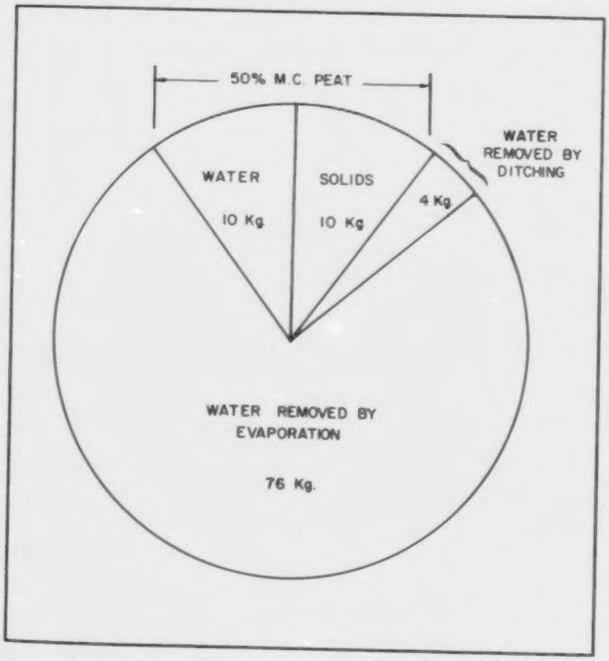


Figure 2.24
Moisture losses from peat resulting from ditching and evaporation.

2.6.2 Climatic Factors Affecting Peat Harvesting

Climatic Data

Complete information on climatic factors of interest relative to particular peat deposits is generally not available. Types of climatic data collected are inconsistent, times at which they have been gathered have varied, and equal representation for peatland areas has not been provided by the distribution of meterological stations.

To standardize the quality and consistency of climatic data used, and to provide a cursory look at variations in climatic suitability for peat harvesting, specific variables have been interpolated from agroclimatic maps of the Maritimes.

The most significant climatic factors affecting peat harvesting are:

1. length of harvesting season,
2. amount and duration of rainfall,
3. duration and frequency of fog, mist and drizzle,
4. duration and intensity of sunshine, and air temperature regime, and
5. wind speed and direction of prevailing winds.

The interaction of these factors varies throughout Atlantic Canada,affecting the amount of potential evapotranspiration (PE) and the extent of occurrence of soil water deficits (WD). These two parameters can provide basic indications as to the suitability of a particular region for peat harvesting.

Climatic Factors

Climatic values have been interpolated from maps with 2 inch (50 mm) contour intervals (with 50 percent probability) in the case of water deficits, and 10 day intervals in the case of freeze free periods. Also some variables such as fog and precipitation frequency and duration, may be either weakly incorporated in the chosen parameters or not represented at all.

Precipitation

The amount of precipitation is not as critical to peat production as the frequency and duration of rainfall. Drainage systems employed in peat operations are designed to remove brief bursts of rainfall from the production area fairly quickly. However longer duration of rain will hamper production, setting back harvest schedules.

Fog, Mist and Drizzle

Fog, mist, and drizzle, associated with coastal and highland areas, prevent sunshine and warm air temperatures from reaching the peat surface, stopping evaporation and sometimes rewetting the dried peat. Areas of the province in proximity to cool offshore ocean surface temperatures will most likely have an increased frequency of fog and mist.

Sunshine Duration and Intensity
The ability of air near the bog surface to absorb evaporating water from the peat is greatly enhanced by warm air temperatures. Near coastal zones, cool oceanic temperatures often lower the water absorption capacity of air moving over the bog. As sunshine effectively heats up the ground and subsequently the air, the water holding capacity of the air increases.

Wind
Wind is an important factor in the drying of peat. As a result of evaporation, moisture laden air remains close to the peat on the drying surface. The drying process is greatly enhanced if a constant exchange of dry air is provided by gentle breezes. However areas with excessive windspeeds may experience loss of the finer peat and infilling of ditching systems.

Seasonal Factors

Length of Harvesting Season
The duration of the harvest season provides a base of comparison, indicating the length of time in which suitable harvesting conditions are likely to prevail. For the purposes of this report, the harvest season is defined as the period of time between the last spring frost and the first fall frost (Freeze Free Period (FFP)).

Potential Evaporation (P.E.) and Water Deficits (W.D.)
These two descriptive parameters use all of the daily factors described above, and provide an indication of the potential suitability of a region for peat drying.

Potential evapotranspiration (P.E.) is the maximum amount of water lost as water vapour by a continuous stretch of vegetation with unlimited water supply. It includes the effects of both evaporation and transpiration. The calculation of P.E. incorporates daily temperature, sunshine, wind, and humidity (fog, mist).

Water deficits (W.D.) are indicies which estimate the potential loss of water from the ground. Normally these indicies estimate the requirements for irrigation. However they may be used to estimate the relative dryness of the region. The calculation of this index requires information on daily precipitation and daily P.E.. If it is assumed that the biological loss of water and the availability of soil moisture is equal through each region, water deficits can be used to compare the relative daily dryness of two or more regions (Agriculture Canada 1974).

Climatic Comparison
Potential for peat production, in areas currently not producing peat, can be estimated by extrapolating average production values from areas of similar climatic conditions and for which peat production is known. Several areas of Canada where peat is currently harvested can serve for comparison.

Peat production in northern New Brunswick averages 160 tonnes/ha/year (71 tons/acre/year) (Monenco Ontario Limited 1980). A review of maxima for each major climatic factor in the Atlantic region showed that values recorded for New Brunswick represent only 71% of optimum conditions. For example the maximum frost free period for Atlantic Canada has been estimated as 170 days — northeastern New Brunswick has a FFP of about 120 days. If a peat production of 70 tons per acre per year (160 tonnes/ha/yr) can be achieved under average New Brunswick conditions, 100 tons per acre per year (225/tonnes/ha/yr) is theoretically possible under optimum conditions. This production has been used as a reference point for calculation of potential production for Atlantic Canada.

Table 2.14 provides a list of the various regions of Atlantic Canada and provides an estimate of anticipated annual production capacity based on each of three major climatic factors.

2.6.3 Discussion

The average annual fuel peat production capacity of Northeastern New Brunswick has been determined, based on the experience of the regions peat producers, to be approximately 71 tons per acre (160 tonnes/hectare). Due to the climatic conditions described in Table 2.14, this area normally falls 29 percent short of maximum possible production. Under ideal conditions maximum annual production yield for the region would therefore be roughly 100 tons per acre (225 tonnes/ha). This value is intended for reference only and under normal conditions would not be achieved. In fact, production achieved in Kings County, Nova Scotia, which has only a 22 percent loss in total possible production capacity, appears to represent the true maximum for the Atlantic Region. This area has the best average climatic conditions of the region and has an annual production estimated around 78 tons per acre (176 tonnes/ha).

It may be inferred from Table 2.14 that three areas appear to be most favourable for peatland development. These include, as would be expected, the established peat producing regions of the Atlantic region; northeastern New Brunswick, and Kings and Hants Counties in Nova Scotia.

Maximum	Water Deficits* (May-September)		Potential Evapotranspiration (May-September)*		Average % Loss Water Deficits and Potential Evapotranspiration	Freeze Free Period+		Total % Loss in Maximum Production Capacity	Anticipated Annual Prod. Capacity for Fuel Peat (Tonnes/ha)
	Mean (mm)	% Loss in Prod. Cap.	Mean (mm)	% Loss in Prod. Cap.		Mean Days	% Loss in Prod. Cap.		
Atlantic Region	175	0	450	0	0	170	0	0	225
Kings County area	150	14	425	6	10	150	12	22	176
N.E. New Brunswick	175	0	450	0	0	120	29	29	160**
Hants County	150	14	400	11	12	140	18	30	158
Cumberland County	150	14	425	6	10	130	24	34	148
Halifax County	125	29	400	11	20	145	15	35	146
S. W. Nova Scotia Coastal area	75	57	375	22	40	170	0	40	135
Cape Breton Coastal area	100	43	375	22	30	150	12	42	131
S. W. Nova Scotia Inland area	10	43	350	17	30	150	12	42	131
Cape Breton Highland area	125	29	400	11	20	130+	24+	44	126
Guysborough County	100	43	350	17	32	135	21	53	106
Pictou County	100	43	425	6	24	120	29	53	106
Newfoundland Avalon Peninsula	75	57	375	22	37	130	24	61	88
Newfoundland Central	100	43	350	17	32	110	35	67	74

*Taken from Agriculture Canada, 1976, "Agriculture Atlas", Ottawa, Ontario

**Monenco Ontario Limited 1980

+Freeze Free Period — information available for this Cape Breton Highlands is not considered representative. The nearest stations were in Baddeck and the Margaree Valley which may not truly represent this region.

Table 2.14
Climatic factors relating to peat harvesting rates.

Northeastern New Brunswick enjoys the highest water deficits (6.9 inches [175 mm]) and P.E. rates (17.7 inches [450 mm]) in the region. Kings County has similar values of water deficit (5.9 inches [150 mm]), and P. E. rate (16.7 inches [425 mm]). A consideration of these values results in an average difference between areas of 10 percent in assumed peat potential production. However, Kings has 17 percent more production potential than New Brunswick when their respective Freeze Free periods are evaluated. A balance of these three parameters leaves the two areas separated by a margin of only 7 percent in potential production yields. As stated above, Kings County has a known production of approximately 78 tons per acre (176 tonnes/ha) in comparison to the known 71 tons per acre (160 tonnes/ha) for northeast New Brunswick.

The third area, Hants County, has an estimated annual potential production around 70 tons per acre (158 tonnes/ha).

Potential peat production estimated for two other areas, Cumberland and Halifax Counties, is not as promising, but still compares very favourably. These areas have estimated annual production yields of 66 and 65 tons per acre (148 and 146 tonnes/ha) respectively. The values represent a difference of 1 percent in probable production between areas and are separated from the three prime areas above by about 8 percent or 8 tons per acre (18 tonnes/ha) annually.

The Cape Breton Highlands, the Cape Breton Lowland area, and southwestern Nova Scotia inland areas, have estimated production capacities between 56 and 60 tons per acre (126-135 tonnes/ha) annually. These levels are still adequate for commercial peat production. However, the Cape Breton Highland freeze free period information is based on data from stations just off the plateau and is not felt to represent actual conditions. The P.E. and W.D. data provided the main insight into potential production rates there.

The remaining areas, Pictou County, Guysborough County, central Newfoundland, and the Avalon Peninsula, Newfoundland, have estimated potential production capacities between 33 and 47 tons per acre (74 to 106 tonnes/ha) annually. Peat production has recently been started in two of these regions, the Avalon Peninsula and Central Newfoundland (Bishops Falls). The operations have not been in place long enough to accurately assess achievable peat production yields, and although some difficulties have been reported, the projects are still on-going.

Although climatic conditions may not affect actual peat production levels quite as has been assumed, the exercise of estimating peat production has resulted in a division of peat areas by climate which can itself be used to estimate the level of peat production expected in each area.

2.6.4 Conclusions

The relative order of suitability for peatland development of areas in the Atlantic Region as a whole, based on expected production levels with dry harvesting methods, is as follows:

Areas with a potential for 158-176 tonnes/hectare/year.
- Kings County
- Northeastern New Brunswick
- Hants County

Areas with a potential for 146-148 tonnes/hectare/year.
- Cumberland County
- Halifax County

Areas with a potential for 126-135 tonnes/hectare/year.
- Cape Breton Island[1]
- Southwestern Nova Scotia Inland
- Southwestern Nova Scotia Coastal

Areas with a potential for 74-106 tonnes/hectare/year
- Guysborough County
- Pictou County
- Central Newfoundland
- Avalon Peninsula, Newfoundland

Areas in Nova Scotia and the Maritimes as a whole have been identified as having prime climatic conditions for peat production, and still others have been presented as having less favourable conditions. It should be noted that even in some of the least favourable areas, peat production is currently being carried out.

(1) The potential yield may be somewhat lower than stated. Climate here is more severe than at the nearest weather recording station, which provided the data on which the estimate is based.

Chapter 3

The Future of Peat in Nova Scotia

3.1 The Economic Value of Peatlands

3.1.1 Introduction

Peatlands are almost unknown to the general public except as sources of peat moss or as a no mans land infested with bugs and soaked with water. However, peatlands have several intrinsic ecological and economic values that make them worthy of public awareness.

For the sake of simplification Nova Scotia's peat resource has three primary economic or potential commercial uses:

1. production of peat moss and associated by-products,
2. fuel peat production and utilization, and
3. as land for the cultivation of various cole, forage and wild crops.

The drainage of peatlands for silvicultural and horticultural crop production is common practice in many European countries. However, these practices are still fairly new to Nova Scotia.

Cultivation of carrots, lettuce, potatoes, and various cole crops on peatlands has been demonstrated in Nova Scotia (Chipman and MacKay unpublished report, Agriculture Canada, Kentville, N.S.). Cranberry cultivation has also been attempted, with some limited success (unpublished material, Nova Scotia Dept. of Agriculture and Marketing, Truro).

The development of peatlands for extraction of moss peat and fuel peat products, shows a great deal of potential in the province. There are many varied uses of peat and peat products, both in horticultural and energy markets.

This chapter will provide information on both the natural and economic values of peatlands, with particular reference to the extraction of peat for industrial use. The chapter also provides an overview of standard methods of peat extraction, an assessment of the feasibility of peat harvesting in Nova Scotia, and consideration of some of the potential impacts of peatland development.

3.1.2 The Harvesting of Peat

Peat harvesting has been practiced for centuries to supply fuel for cooking and home heating. The most traditional method is hand cutting the peat into sods, drying them in the fields, and piling them for later use. Although this method is still in use, increased demand for horticultural and fuel grade peat has led to much larger scale peat production methods. Modern production operations utilize many large pieces of equipment and require vast expanses of peatland to meet demand.

Two principal methods of peat harvesting are dry harvesting and wet harvesting. Dry harvesting is the more popular method.

Dry Peat Harvesting

The dry harvesting of peat relies on natural environmental conditions (sunshine, wind etc.) to dry the peat at the surface of the peatland before removal for use. Dry harvesting techniques remove peat from the deposit in the form of chunks or "sods" or in a powder or "milled" form.The following section describes practices currently used successfully in dry peat harvesting and illustrates the current scale of peat operations.

Pre-production Phases
Prior to peat harvesting, two pre-production operations, bog drainage and surface preparation, allow for peat drying and the access of heavy production machinery.

Drainage
The level of groundwater in an unharvested peatland lies just beneath the surface. Preparation of the peatland involves lowering the water table through excavation of a network of ditches. A level is maintained that prevents moisture "wicking" up to the drying surface, yet which is high enough to lend stability to the surface for support of harvesting machinery.

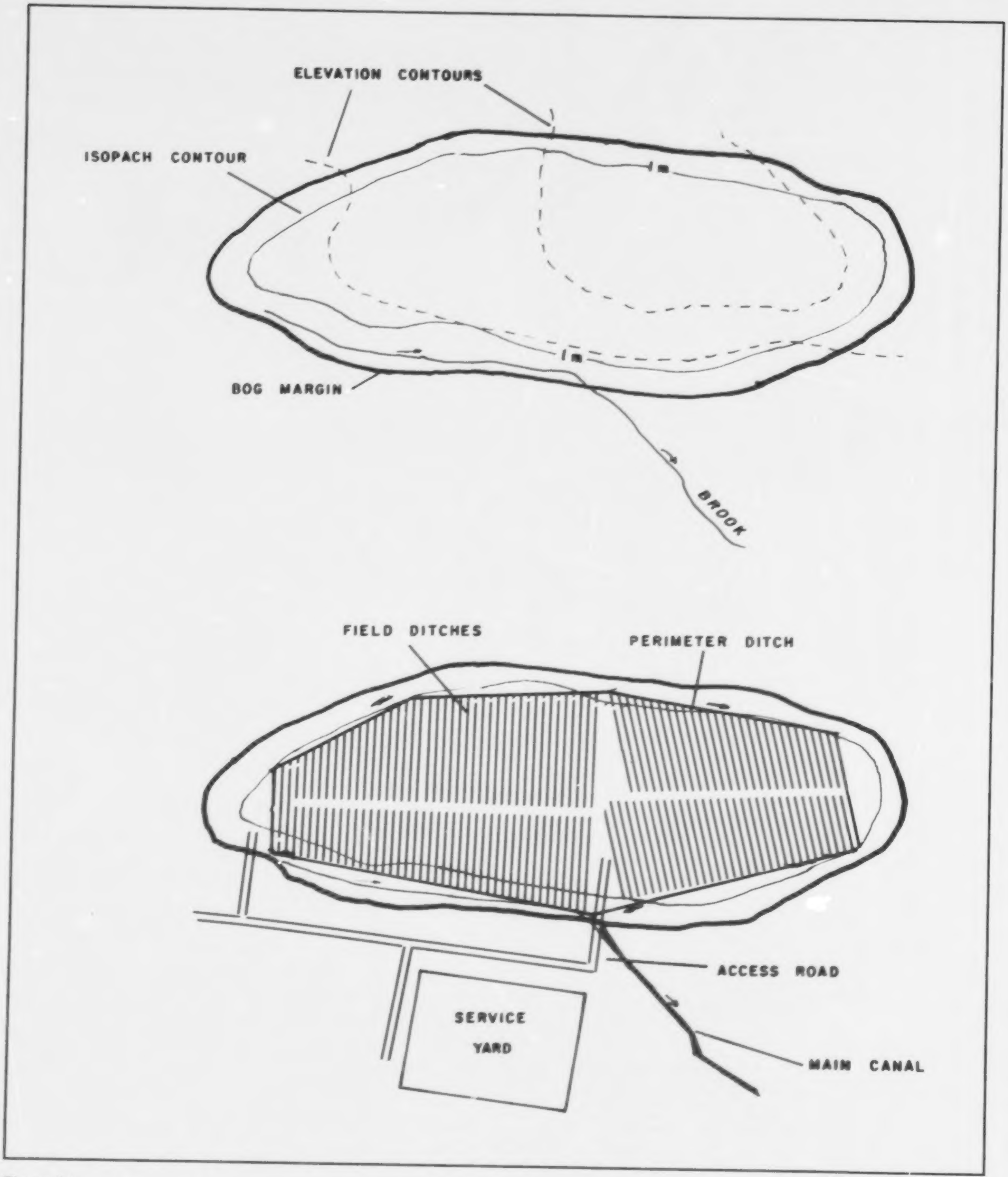

ELEVATION CONTOURS
ISOPACH CONTOUR
1m
1m
BOG MARGIN
BROOK
FIELD DITCHES
PERIMETER DITCH
ACCESS ROAD
SERVICE YARD
MAIN CANAL

Figure 3.1
Typical drainage plan for peatland development.

The production area is made up of fields 50-70 feet (15-20m) wide, separated by ditches which run to main ditches at the ends of fields leading to a trunk drain (Figure 3.1). The trunk system of ditches removes water quickly from the production area and usually ends at a natural water course. Perimeter ditches are used to isolate the production area from the surrounding water table. Ditching plans or layouts are designed to minimize the number of bridges or culverts and reduce excessive travelling over the developed surface. This reduces overhead costs as well as reducing damage to the fields.

Surface Preparation

Before production can begin, the surface of the fields must be levelled. This is done by first removing the surface vegetation along with some of the peat overburden. The exposed surface is then crowned and smoothed to create a level surface for peat harvesting (Figures 3.2 and 3.3).

Milled Peat Production Phases

Prior to harvesting the peat is milled and turned several times. To lift the milled peat off the surface, large vacuums attached to tractors are pulled repetitively across the bog (Figure 3.4). The height of the vacuum nozzle can be adjusted to allow for selective harvesting of the driest peat. The peat collected is dumped into stockpiles at the end of the production fields. Stockpiled peat is then transported off the fields to a central stockpile, or directly to a thermal plant or to other industrial users (Figure 3.5).

One producer in New Brunswick and one in Newfoundland use the "ridge method", which differs from the above only in its collection techniques. Tractors use wide plow blades to scrape the dried peat into windrows in the centre of the production fields. After several days these field ridges can be combined using conveyors, or loaded directly into trailers for transportation to a central stockpile. The "ridge method" is more weather dependent, relying on a longer drying period. However it has the advantage of having a higher production output and lower operating costs than vacuum harvesting. (Monenco Ontario Limited 1981)

Block Cut Peat Production

Block cut peat production involves the extraction of blocks of peat from a vertical face in the peat deposit. The blocks are stacked wet and are turned once or twice during the next three months to promote drying. The peat blocks are then taken to a plant where they are shredded to produce a long fibrous moss for horticultural use. In Canada, block cut peat is used primarily for horticultural purposes.

Sod Peat Production

Sod peat is produced most notably for use as a fuel. It is easier to handle in small and medium scale industries than the loose, low bulk density, milled peat.

One form of sod peat is commonly produced by large machines referred to as "baggers" (excavators). The machines are simple crawler mounted tractors using a bucket excavator to cut peat from a deep vertical face in the peat. A deep cut allows for complete mixing of peat, as well as for one pass removal. As it is removed from the cut, the peat is mixed and then kneaded before being extruded onto a chain belt travelling the length of a 30-60 metre spreader arm. When the peat reaches the end of the arm, it is tipped onto the surface of the bog for drying. A series of cutting discs trailing the arm cut the peat into sods. These sods are left to dry on the fields and are harvested in a manner very similar to the ridge peat method (Callanan 1972). Peat sods produced in this way tend to be quite uniform in quality because of the mixing that takes place.

In many sod peat operations, smaller machines attached to tractors produce sods that lend themselves to mechanized handling. These machines cut peat from angled slits in the bog, macerate it, and extrude it onto the field surface. The sods are turned several times before being ridged, collected, and transported to the stockpile in a manner similar to the bagger harvesting method (Figure 3.6).

The use of the smaller sod extruders provides a greater flexibility in the selection of production areas, as well as reducing the potential downtime losses that would affect operations relying on one or two of the large sod extruders or "baggers" as used in Europe.

The production of peat sods is not new to Canada. In 1910-1915 about 5000 tons (4500 tonnes) of peat sods were produced in Ontario at the Farnham and Alfred bogs using large digging and spreading machines. The machines cut and spread the peat, but the sods were all turned and stacked by hand (Anrep, 1911; Haanel 1926). The sod peat machines were large and cumbersome, and required large tracts of peatland to operate. Similar machines are still in use in Ireland, Germany and Sweden.

Figure 3.2
Surface preparation of peatland.

Figure 3.3
Prepared surface of peat production field.

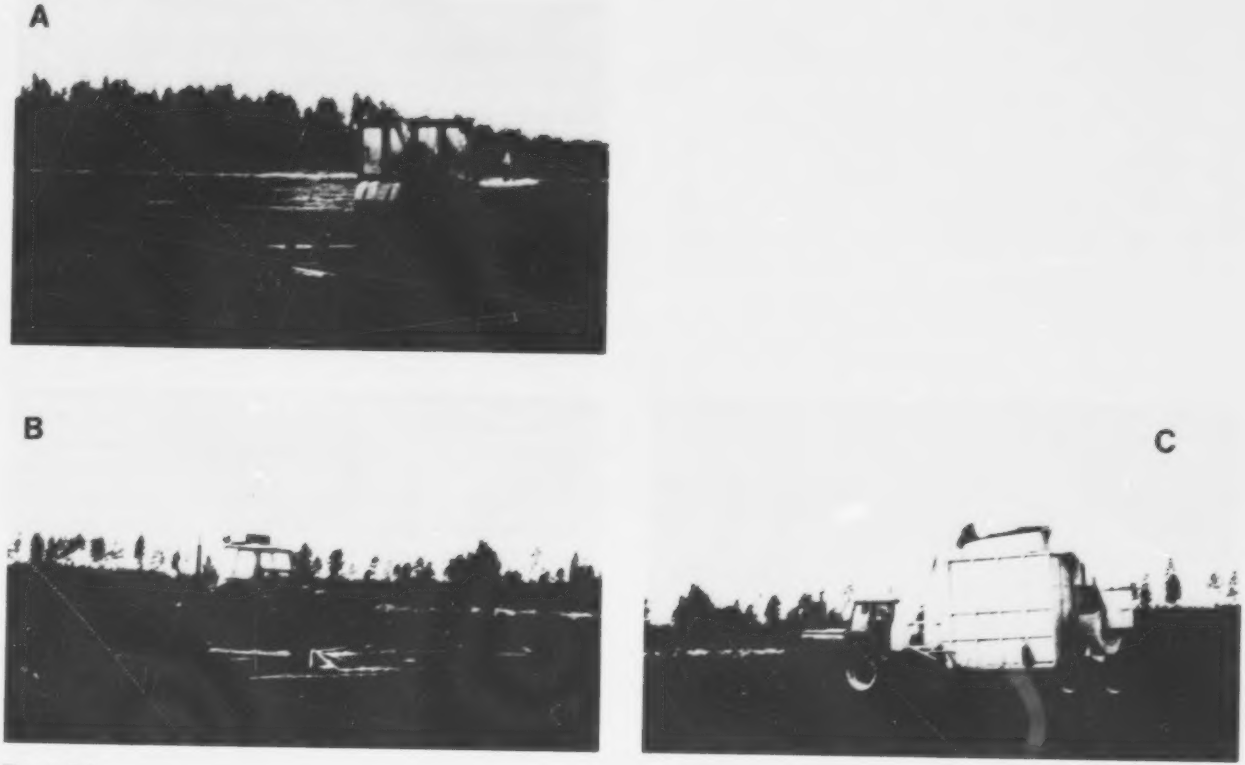


Figure 3.4
Milled peat production and vacuum harvesting. A. Production milling. B. Peat harrowing. C. Vacuum harvesting.

Figure 3.5
A large central stockpile at a briquetting factory in Finland.

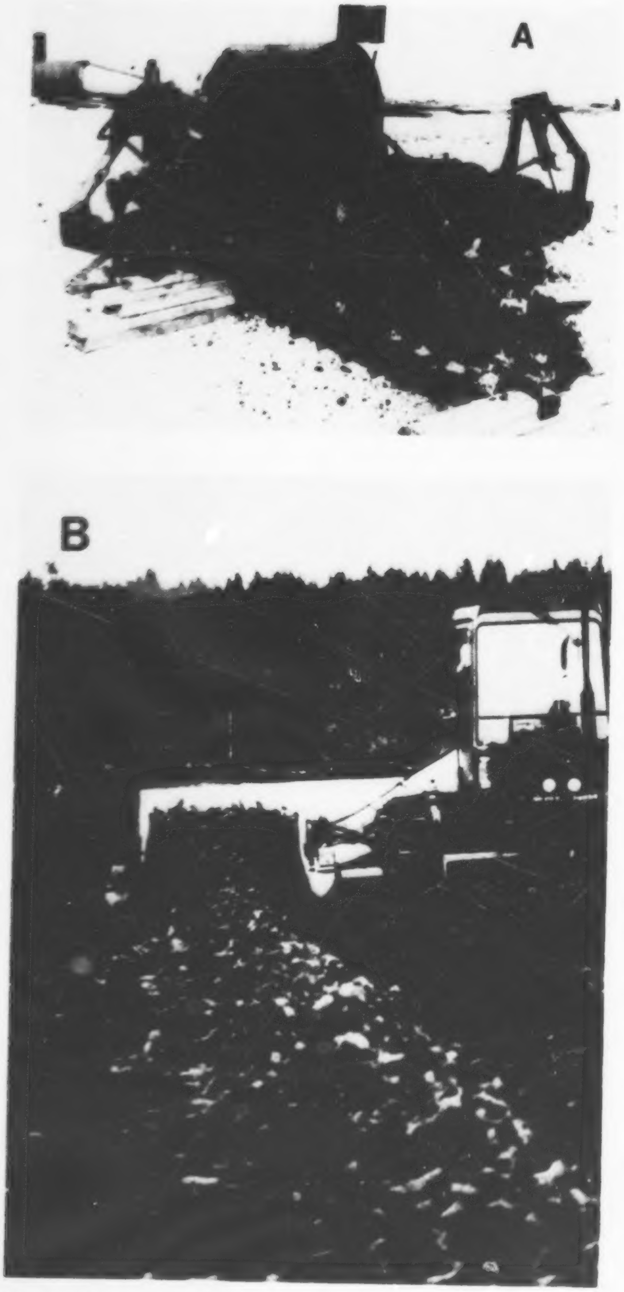


Figure 3.6
Sod peat harvesting. A. Herbst Difco Turf Cutter (sod extruder). B. Collection and loading.

Wet Peat Harvesting

Dry harvesting of peat is limited to 3-4 months during the summer when the peat can dry naturally, but wet or hydraulic harvesting can be conducted eight or nine months of the year, sometimes year round. In wet harvesting, peat is pumped as a slurry from a dredge to a dewatering plant for artificial drying. Various types of barges and dredges have been used. In some cases hydraulic "monitors" (spray guns) have been used to wash peat into a slurry pond. Clam shells, draglines, and backhoes mounted on barges, have been used to harvest peat (Figure 3.7). In Nova Scotia, a small hydraulic harvesting operation used a barge, suction pump, and conveyor system to harvest horticultural peat from bogs in the Canso area.

The peat slurry used in wet harvesting is usually only 2.5 percent solid matter (peat). Dewatering of the slurry can raise solid content to 35 percent. The majority of wet harvesting operations have used different types of belt and roller presses to dewater the peat. Presses work at about 75 to 85 percent efficiency depending on the state of humification or fibre content of the peat. Recently wet suction techniques used in Finland have been up to 90 percent effective in lowering the moisture content of non-fibrous peat to 55 to 65 percent. However the technology is more cost effective on higher value materials such as mineral slurries. The Finnish wet suction method, coupled with condensation dryers, is capable of producing 45 to 50 percent moisture content peat with virtually no loss of material (Valmet O.Y.; Bjarne Ekberg, Paper Machinery Group, Valmet Corp., Finland, personal communication).

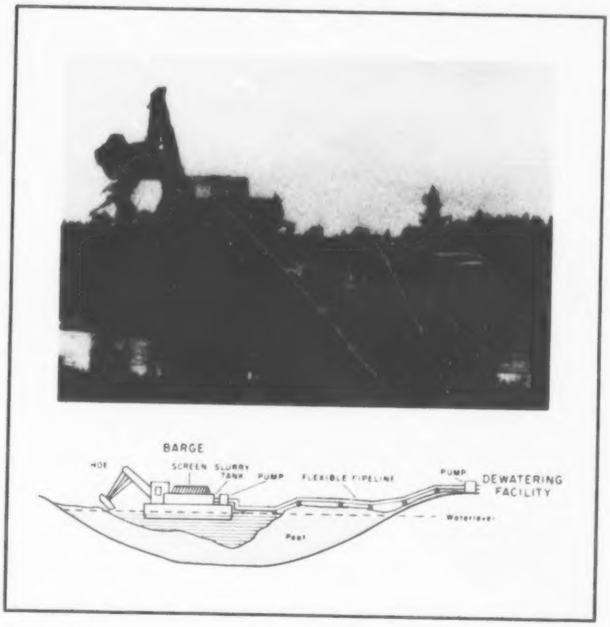


Figure 3.7
Hydraulic mining of peat.

3.1.3 Economic Viability of Fuel Peat Production and Utilization in Nova Scotia

To become a viable alternative to liquid fuels, solid fuels such as peat have to be easily handled, cheap to burn and control, and as well provide significant energy cost savings to consumers.

Energy cost savings generated by using less expensive solid fuels must be enough to offset installation costs and additional maintenance, and must provide a short payback period (2-3 years). Prior to conversion to solid fuels, the consumer must be assured that the fuel will be securable at competitive prices for relatively long periods of time.

Large Scale Applications

The use of peat for utilities is commonplace in countries such as Finland, Ireland, and the U.S.S.R., where very large base peat resources and energy demands exist. However, large 40-50 MW peat fired thermal electric plants that are feasible in Europe, may not be so in Nova Scotia because of the rather limited population base and limited resources. A 40 MW thermal electric plant would require on the order of 380,000 tonnes of peat, usually in the form of milled peat, annually. At the known annual production rate for Northeastern New Brunswick (160 tonnes/ha), Southwestern Nova Scotia's inferred resources could support such a facility, but the annual peat demand would exhaust the inferred reserves in less than 35 years and known reserves in less than 20 years.

Large scale applications may not be feasible until further reserves have been proven or until fossil fuel prices rises to a point where the construction of a 10-20 MW plant would be cost effective. A typical 10-20 MW plant is illustrated in Figure 3.8.

Where solid fuel reserves and markets exist, the economic viability of fuel peat production will depend on the cost of other solid fuels such as forest residue, mill waste and woodchips. To compete on the same cost per unit energy level, peat will have to be delivered to the consumer for roughly $30-45 per tonne. To provide fuel at this delivered cost, production levels will probably have to exceed 20,000-30,000 tonnes per annum (Technopeat 1984). Markets in regions such as southwestern Nova Scotia, where the fuel peat resources are large enough to support this level of production, would be primarily small to medium scale industries whose annual peat demand would vary from 1000 to 4500 tonnes. Figure 3.8 shows the relative scale of small to medium sized peat fired heating plants.

To be more attractive to these consumers, peat would have to be delivered on a regular basis in a manageable form. Milled peat tends to be very dusty and hazardous under some conditions, and thus peat sods or chunks would be more appropriate, although a little more expensive.

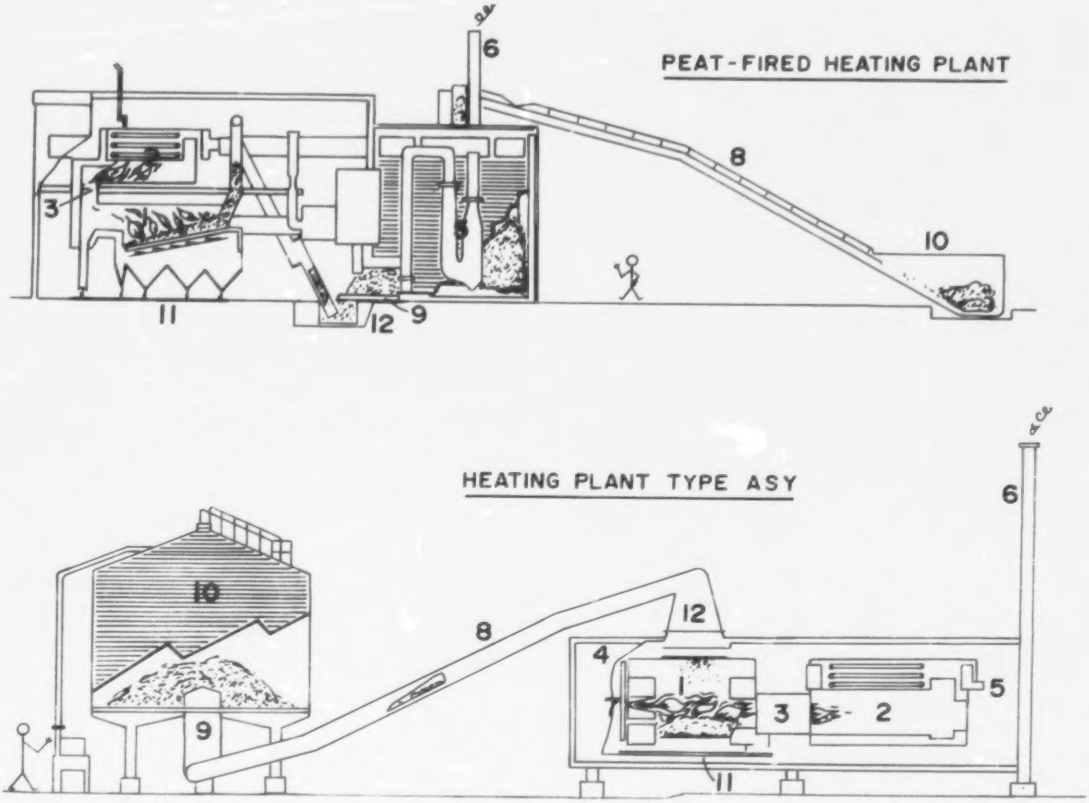
Currently solid peat combustion systems are very large capital investments. However, if sufficient price margins and suitable energy demands existed in these industries, conversion costs could be repaid within a few years. As shown in Figure 3.9, energy cost savings begin to be realized using peat when oil prices are above $0.14/l (No. 2) and $0.18/l (No. 6). Under current production costs, i.e. $30-$45 per tonne peat (delivered), peat begins to provide savings when oil prices would exceed $28 BBL (CDN).

Assuming that peat can be delivered for a cost of between $30-35 per ton ($3.00-3.50 per million BTU) and energy costs for No. 6 and No. 2 fuel oil are as illustrated in Table 3.1., a small to medium scale consumer could realize a fuel cost saving of as much as 40 to 50 percent for displacing No. 6 oil, and 50 to 60 percent for displacing No. 2 fuel oil.

Fuel	Cost per Unit Delivered ($)	Cost of Delivered Energy ($/MMBTU)
No. 2 Oil	0.20-0.30	5.45-8.15
No. 6 Oil	0.15-0.21	3.80-5.06
Hardwood Chips	23-27	2.45-2.85
Coal	75-80	3.00-3.50
Sod Peat (Probable)	30-45	3.00-4.50

Table 3.1
Comparison of Delivered Costs of Various Fuels (December 31, 1986)

A small consumer currently using 80,000 gallons of light fuel oil annually would require approximately 1000 tonnes of peat to generate 90% of the maximum operating load (assuming 10% of energy demand is met with oil to reach peak operating loads). At roughly $0.31/litre ($1.40/gallon) for light oil, the consumer's annual oil bill would be $112,000, while the cost for peat at $35 tonne would be $35,000, a saving of $77,000 or 69% plus overfire oil. If the same consumer acquired a 70 HP (0.36 MW) boiler package costing $150,000, the simple payback period would be less than two years. However, at late 1986 prices (Table 3.2), this same consumer would pay $0.21 per litre ($0.95 per gallon), or $76,000 annually. Savings would only be in the order of $44,000 or 37%, providing a simple payback within four years. The viability of peat as an alternate fuel lies in the context of overall cost savings and security of supply. If the cost of solid fuel systems reaches a level at which consumers can realize a cost benefit in the form of a short payback period along with secured fuel supply, then peat could play an important role in reducing oil demand in the commercial and industrial sectors.


PEAT-FIRED HEATING PLANT
HEATING PLANT TYPE ASY
1
2
3
4
5
6
7
8
9
10
11
12

— LIST OF EQUIPMENT —

1	Front Furnace
2	Boiler
3	Intermediary Channel
4	Combustion Air Fan
5	Flue Gas Cleaner and Flue Gas Absorber
6	Stack
7	Ignition Burner
8	Fuel Conveyer
9	Fuel Unloading Device
10	Fuel Store
11	Ash Remover Screw
12	Boiler Feeding Hopper

Figure 3.8
Typical peat fired heating plants.

Region	Measured Resources					Inferred Resources Volume × $10^6 M^3$		
	Total Area (ha)	Surveyed Area	In situ Surveyed Volume × $10^6 M^3$					
			Moss	Fuel	Overall	Moss	Fuel	Overall
Southwestern Counties Yarmouth, Shelburne Queens	54 515	17 875	177.0	221.0	398.4	541	674	1 215
Central Counties Kings, Hants, Cumberland, Pictou	18 105	6 261	121.5	56.5	178.0	351	163	514
Eastern Counties Halifax, Inverness Guysborough, Cape Breton, Richmond, Victoria	52 010	9 083	173.5	43.6	217.1	994	250	1 244
Remainder Non Inventoried Regions Digby, Annapolis, Colchester, Lunenburg, Antigonish counties	37 185	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Total	161 815	33 219	472	321	793	2 299	1 564	3 862

Table 3.2
Measured and inferred peat resources of Nova Scotia

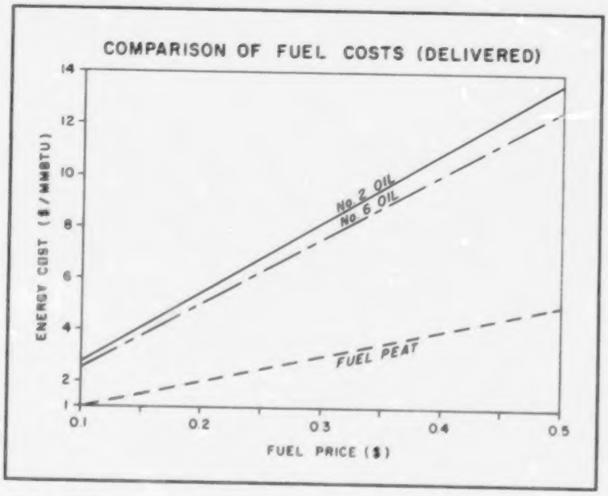


Figure 3.9
Cost comparison of oil versus fuel peat.

Domestic Applications

Once a commercial peat harvesting operation has been developed, and has secured long term supply contracts to make up a base production level, it can sell some peat fuel for domestic use. For household use, peat can be burned in a modified wood-coal capable stove, furnace, or fireplace.It produces a warm steady heat similar to coal. Currently peat is being sold as briquettes, charcoal, and in the raw chunk or sod form, in many countries in Europe. Where it is sold in Canada it is priced comparatively to wood.

3.1.4 The Feasibility of Peat Production in Nova Scotia

There is a great potential for development of peatlands for peat moss or fuel peat extraction in various regions of the province. Nova Scotia peatland resources are very extensive; roughly 400,000 acres (160 000 ha) of peatland have been identified in the Province. The peat resource of these areas is currently estimated at five billion cubic yards (3.9×10^9 M^3) of which three billion cubic yards (2.3×10^9 m^3) have been inferred to be of peat moss grade and two billion cubic yards (1.6×10^9 m^3) fuel peat grade (Table 3.2).

Fuel Grade Peat Potential

Roughly 30 percent of the provinces peat resources are located in southwestern Nova Scotia, 45 percent in other major concentration zones, and the remaining 25 percent distributed throughout the Province.

The major fuel peat resources of the Lake Rossignol area occur in seven deposits (Table 3.3). Total potential production area is estimated to be 2025 acres (820 ha), with an average exploitable depth of 7 feet (2 m). The average "life expectancy" for each area is 15-20 years, depending on harvesting rate and the depth of the peat. Preliminary evaluation of the reserves of this region indicate about 3.3 million tonnes of fuel peat (50% moisture content), enough to supply 50,000 tonnes annually for 60 years (Table 3.3). The area is well accessed by a network of logging roads leading to a major secondary road to Liverpool.

The Barrington-Argyle fuel peat resources extend from Clyde River to Yarmouth, and exist primarily within a few miles of Highway 103, the main transportation route.

Few other areas of the Province with significant fuel reserves were found. Only three sites outside southwestern Nova Scotia were delineated; a deposit at Lake Ainslie, Inverness County, "Shaws" bog in Falmouth, Hants County, and the Aylesford Bog in Kings County.

The Lake Ainslie deposit, although composed of fuel grade peat, occurs in a bog which is, for the most part, at or below the resident groundwater system. It has also been recommended as a valued unique ecological site. "Shaws Bog" in Hants County is potentially harvestable for fuel grade peat, but the deposit is small, low lying, and heavily treed. The Aylesford bog in Kings County is also potentially harvestable for fuel peat. Peat moss harvesting is currently underway there, and there are a number of potential markets for fuel peat in the region. This deposit is roughly 730 acres (295 ha) in size of which 250 acres (100 ha) can supply fuel grade peat. Assuming an average of 2 meters (6 ft) of fuel grade peat, this deposit could supply 420,000 tons (380,000 tonnes) of exploitable fuel.

Peat Moss Resource Potential

Peat of moss grade can be found throughout the province. Almost every deposit surveyed had a substantial layer of moss peat overlying the fuel grade peat. For the most part this peat was a pure or nearly pure *Sphagnum* based peat. Minor occurrences of shrub and sedge remnants could be found in most deposits. However in the surficial layer of harvestable deposits these constituents were not significant. The grade of the peat surveyed appeared to be quite high, with H_3 peats the most common. This is a very light, fibrous grade of peat, with very high water retention capablities (linked to the high structural integrity of the peat and low amorphous material content). Data collected by Sutherland and Shea (1976) and Leverin and Cameron (1949) indicate similar findings in various bogs surveyed in their respective reports. Water holding capacities for Nova Scotia moss peats were estimated to be between 15 to 25 times their sample weight at 25 percent moisture content.

Roughly 30 of the deposits surveyed in the current program show excellent potential for commercial development. Although there are many more deposits yet to be inventoried, and smaller deposits or groups of deposits with suitable harvestable reserves, the moss peat resources outlined in Table 3.4 warrant strong consideration for resource development. The current survey has indicated that there are about 20,100 acres (8 140 ha) of harvestable moss grade deposits in Nova Scotia, containing some 180 million cubic yards (136 Mm^3) of peat moss. Assuming a 75 percent recovery, this would be equivalent to 410 million bales of peat moss.

Several areas are shown to hold substantial peat moss reserves (Table 3.4). However the harvestability of the resource depends on a number of factors, such as shape and size of the deposit, climate of the region, height above local groundwater table, and distance from an export centre.These factors are evaluated in Table 3.5.

Deposit	Exploitable Area (ha)	Fuel Peat Reserves		Moss Peat (Overburden) Reserves
A) Lake Rossignol area		($\times 10^6 M^3$)	($\times 10^6$ tonnes)*	($\times 10^6 M^3$)
P11-5	150	2.38	0.45	0.41
P12-7	45	0.80	0.15	0.04
Q12-3	105	2.50	0.48	—
Q11-2a	45	0.70	0.13	—
Q11-2	35	0.70	0.13	—
Q12-4	370	9.04	1.72	1.63
P14-3	70	1.44	0.27	—
Total	820	17.56	3.33	2.08
B) Barrington-Argyle area				
U7-12	85	1.80	0.34	—
U7-23	45	1.34	0.25	0.07
U7-27	35	1.19	0.23	0.16
U8-12W	190	4.39	0.83	0.16
U8-120	25	0.59	0.11	0.09
U8-17	40	1.13	0.21	0.14
U9-7	15	0.22	0.04	—
U9-11	30	0.42	0.08	—
U9-13	75	1.38	0.26	0.18
T7-5	70	1.20	0.23	0.03
T7-9	125	2.47	0.47	0.81
T9-7	70	1.30	0.25	0.28
Total	805	17.43	3.30	1.92

*A conversion factor of 0.19 tonnes/M^3 is used to derive an in situ tonnage at 50% M.C.
(Montreal Eng. Monenco and ADI Ltd. 1980)

Table 3.3
Harvestable fuel peat resources of Southwestern Nova Scotia

Region	Number of Potentially Harvestable Bogs*	Total Area Harvestable	In situ** Harvestable Volume	
			× 10^6M^3	× 10 Bale Eq.
Southwestern N. S.				
Lake Rossignol	8	2 870	30.9	93
Inland	2	300	4.2	13
Barrington-Argyle	8	1 379	21.7	66
Central Nova Scotia				
Hants Co.	3	1 010	33.5	100
Kings Co.	1	215	3.2	10
Pictou Co.	N.A.	N.A.	N.A.	N.A.
Cumberland Co.	3	1 320	21.0	63
Eastern Nova Scotia				
Guysborough Co.	3	475	8.3	25
Cape Breton High.	1	134	2.3	7
Cape Breton East	2	266	5.5	16
Halifax Co.	1	170	5.4	16

*Harvestable deposits are defined as having 100 ha or greater with 1m of surficial peat in areas where overall peat depth is greater than 1 m in depth.

***In situ* volumes are for moss grade peat only. 1 M^3 of *in situ* peat will yield three 170 l (6 cu ft) bales of peat moss.

Table 3.4
Potentially harvestable peat moss deposits (Surveyed Bogs, inventoried from 1980-1985)

Region	Character of Deposits	Approximate Distance to Export Center	Peat Profile	Climatic Variables	Other Remarks
Southwestern Nova Scotia	large, irregular shaped bogs with extensive, relatively flat domes	— 30 miles (Liverpool) — 60 miles (Yarmouth) — 180 miles (Halifax)	weakly defined moss layer, often mixed with thin layers of fuel grade	long freeze free period, high frequency of fog in coastal zones	inland deposits at or near ground water levels, substantial fuel resource in the region
Central Nova Scotia					
Cumberland Co.	large regular shaped bogs with evenly sloped domes	— 100 miles (St. John, NB) — 110 miles (Halifax)	well defined moss peat layers, however deposits often shallow with small harvestable areas	moderate freeze free period; average fog and rain days for Atlantic Region	very high resident water table in area of Tantramar Marshes
Hants Co.	large well domed regularly shaped bogs	— 40-60 miles (Halifax)	very thick, well defined moss peat layers	moderate freeze free period, low fog frequency	deposits near railway and highways leading directly to Halifax for export
Eastern Nova Scotia					
Guysborough	small deposits forming a number of peatland complexes	— 90 miles (Pt. Hawkesbury) — 120 miles (Halifax)	large lenses of well defined moss grade peat	moderate freeze free period; frequent fog occurence	deposits have very good peat moss, often raised above surrounding terrain
Cape Breton Highlands	small deposits	— 120 miles (Sydney)	thin well defined peat moss layers	short freeze free period, frequent fog and rain	large number of deposits, many unique to N.S.
Cape Breton East					
Sydney Basin	relatively large peat moss deposits	— up to 50 miles (Sydney)	good peat moss layer above thin fuel grade peat layer	moderate freeze free period cool moist climate	fairly good potential for peat moss development if environmental conditions allow for sufficient annual production
Eastern Coastal Plains	large number of peatland complexes	— 60 miles (Sydney) — 60 miles (Pt. Hawkesbury)	good moss peat, coastal bogs have large number of bog pools	moderate freeze free period cool moist climate and frequent fog occurrence	area may not yield sufficient annual production per unit area to warrant development

Table 3.5
Local factors affecting the expansion of the peat moss industry in Nova Scotia

3.2 The Impacts of Peatland Development

3.2.1 Potential Environmental Impacts of Peatland Development

The disturbance of any ecosystem by man, be it by the clearing of land for agriculture, forestry, or mining, induces a wide range of effects that have varying degrees of impact on existing biotic and abiotic systems. The following sections will briefly describe impacts that may be expected to occur should large areas of peatland be developed in the Province.

Peatland Drainage

By their very nature, peatlands develop in areas where high levels of groundwater or surface water exist. Under natural conditions, most peatlands in Nova Scotia are saturated with water to the point where the existing water table may be at, or just below, the surface of the bog. In most cases the level of the water table rarely changes more than a few centimeters, because of the moist maritime climate. This very high water table leaves little potential storage for precipitation, and runoff peaks entering the peatland are immediately felt on downstream areas.

Drained, the same bog area would have a lowered water table (20 to 30 cm below the surface in the middle of the production fields and 50 to 80 cm below the surface near the ditches). The result is an increased short term storage capacity in the bog, delaying runoff into the outlets until the water can percolate through the drained peat. Annual runoff from the bog would not be greatly increased, but the peaks in runoff would be stabilized as water is released slowly from the peat into the ditches.

The downstream effects of this flow pattern would be to cause changes in vegetation near the stream, increased sediment and colour loads (as there is now exposed peat), and increased movement of organics and organic sediments into runoff, resulting in increased acidity, BOD (biological oxygen demand), and COD (chemical oxygen demand). These factors can shift or cause eutrophication (stagnation) of downstream waters (Technopeat 1986).

Peatlands can develop a water table distinct from the local ground water system (Figure 1.7). The two tables will interact depending upon the percolation or conductivity of the organic and boundary mineral soils. The drainage of a perched water table will have little effect on lowering the groundwater table level. However it may effect its recharge potential.

After the drainage procedures lower the peatland water table below the top of the groundwater system, drainage ditches have the primary effect of removing excess surface recharge plus removing some of the internal water from the groundwater system.

In areas of high recharge capacity, peatland ditches normally only affect a small area within 50 metres of the ditch. Lowering of the water table near the bog margin in a number of instances has proven beneficial because of increased vegetation growth and the expansion of wildlife habitat (Technopeat 1984).

Peatlands are commonly sinks for heavy metals transported through air or water and which chelate or bind to molecules in the organic mat. Drainage waters have increased levels of ammonia, nitrate, nitrogen, phosphorous, aluminium, suspended solids, etc. The construction of sedimentation ponds, and cattail marshes at the outlet of the bog can relieve the increased nutrient loads from bog drainage into natural drainage systems. To ensure that bog waters have little effect on surface water outside the bog, monitoring and sedimentation ponds should be incorporated into the development plan of major peatlands whose exploitation will effect large quanitites of surface water.

Surface Preparation

Open bog or peatland areas used for peat production are relatively low in biological production. Nevertheless these areas support a wide variety of plant and animal life. Usually the edges of the bog are left relatively undisturbed by peatland development. As this is the primary area of biotic production, little significant impact may be expected.

Surface ponds or streams are often frequented by waterfowl, furbearers, and fish that will be affected by runoff or infilling. However in most areas of potential peat production there are nearby areas that provide similar habitat and can support the same forms of wildlife. The displacement of organisms from the developed areas may cause some temporary pressures on surrounding ecosystems. However in most cases pressures are anticipated to be minimal.

The peatlands of Nova Scotia will never all be utilized. Therefore much of the impact from areas which are developed could conceivably be absorbed by other non-utilized deposits near these areas.

Peat Production

The production of peat affects the surrounding environment in a number of ways, including production of dust, noise, traffic, and fire potential. Production of dust can be a nuisance to workers and surrounding dwellings. Wind blown dust will often fill ditches and smother vegetation near the peat bog margin. However, it may be somewhat beneficial to soil conditions near the bog. Most deposits in Nova Scotia are distant from communities and are not likely to create a problem. Sod peat operations have less problems with dust but there is some dust generated in handling and transporting of the sods.

3.2.2 Socio-economic Impact of Peatland Development

The development of any natural resource means an expanded industrial base and an increase in direct expenditure into local economies. Direct employment benefits are one of the primary socio-economic impacts but increased revenues in service industries that would supply the operation with fuel, logistical supplies, equipment, parts and maintenance, will also occur. For example, a small demonstration project of 35 hectares requiring about one million dollars of capital investment over 5 years would contribute an additional $200,000 annually to the local economy (Technopeat 1984).

The use of peat as a fuel would also have a direct impact on the amount of imported oil being used in the region, reducing energy costs for consumers and thus expanding their profit margins. This would lead, in turn, to further industrial growth in the region. The extent to which impacts from peat harvesting will reach into the various economic sectors of the region is difficult to determine. To do so, it would be necessary to analyse some of the existing peat producing areas and extrapolate base assumptions from those regions into Nova Scotia.

3.3 The Economic and Intrinsic Value of Natural Peatlands

Peatlands are one type of wetland ecosystem that provide several intrinsic and economic values or benefits. In their natural state, peatlands regulate or influence the hydrology of watersheds, provide habitat for many forms of wildlife, produce many varied types of wild or "semi-managed" food crops, and provide areas for human recreation and learning.

The hydrological role of peatlands in most watersheds is believed to be as storage reservoirs and filtering bodies that regulate water flow and remove sediments and chemicals such as mineral ions, from water moving through the watersheds. As well, these areas are to some extent considered to level out the flow to the watershed of water from runoff and precipitation. Acting as storage reservoirs, peatlands not only regulate the release of water — they act to maintain higher water tables in the mineral soils adjacent to the deposit. Although there is little information available on the interplay between large expanses of wetlands (peatlands) and the atmosphere, a number of climatic and atmospheric effects characteristic of higher latitudes have been attributed to the occurrence of large wetland areas (Bardecki 1984).

The seepage or flow of water through and over peatlands brings water in contact with organic matter which has a great capacity for "ion exchange". Heavy metals, chemicals, and toxic materials that may or may not be harmful to the ecosystem are often chelated or bound to the organic molecules of peat, effectively removing them from the ecosystem. The reduced rate of flow through peatland vegetation and debris also removes sediments and pathogens by allowing the material to settle out. Although there are still a number of unanswered questions regarding the effect of peatlands on waterflows, and the effect of released peatland sediments on the environment, the potential exists for the development of peatland and wetland areas for use in wastewater treatment and water management programs.

Peatlands also act as storage areas or reservoirs of organic carbon. Recent concerns have attributed the burning of fossil fuels to the increased "CO_2" level in the atmosphere and a potential "greenhouse" effect. This has led to studies concerning the amount of stored carbon or extent of carbon reservoirs available to fix carbon from the atmosphere. Standing forests are obvious stores or reservoirs, as are peatlands.
The Atlantic Provinces are believed to have roughly 2.5 million tons (2 billion tonnes) of stored carbon in 5 to 7 million acres (2 to 3 million ha) of peatland (Boville *et al:* 1983).

The recreational use of wetlands (peatlands), including trapping and hunting of the many furbearers and game species, is an important recreational as well as an economic value of many peatlands. Furbearing species (muskrat, mink, beaver, etc.) contribute about $850,000 annually to the total annual furbearer harvest. Muskrat and other wetland inhabitants make up about 80% of the harvest, and 36% of the total annual market value.

A number of peatlands have been set aside as preservation areas. Most notable are peatlands found within National Parks. "French Mountain Bog" in Cape Breton Highlands National Park is an example of a case where an interpretive boardwalk allows visitors to see the beauty and diversity of the plant life of a highland peat bog. Sites such as these are helping to educate the public to the unique nature of peatlands and to their importance as components of the natural environment.

A number of bogs in Nova Scotia, outside the National Park system, have been recommended as International Biological Preserves (Figure 3.10). These areas represent either unique ecosystems and/or harbour rare or endangered plant species. One such deposit, the Black River Bog at Lake Ainslie, is very unique to Nova Scotia in its form and biological diversity. Some of the unique features of this deposit are shown in Table 3.6. Peatlands such as these provide information the past climate and vegetational history of this region. Stratigraphic analysis of pollen as well as insect parts and charcoal found in the peat provide clues as to the cyclical climatic and fire sequences since the last ice age (Railton 1972, 1975, Ogden 1960; Auer 1930).

3.4 Sensitive and Unique Peatlands in Nova Scotia

As wetland ecosystems, peatlands are perhaps the least productive in terms of wildlife potential. However specific peatlands in Nova Scotia are known to harbour rare or isolated populations of plants and animals. As part of the inventory program special care was taken to make note of unique peatland areas, rare or unusual plants, and environmentally sensitive watersheds. These are summarized in Table 3.7.

During the course of the inventory program at least two deposits which had been listed as valuable ecological preserves, were surveyed to provide not only a record of the peat which was held in these areas but to provide a record of the surface vegetation. These two deposits are the Spinney Heath, in Yarmouth County and the Black River Bog in Inverness County. Spinney Heath is an excellent example of an Atlantic Plateau bog. Open *Scirpus* lawns and fairly steep sided domes are well demonstrated at the site. The Black River Bog, at Lake Ainslie, Inverness County, is a type unique to Nova Scotia. This densly treed, "alkaline" bog has some very unusual plant life (Table 3.6) as well as some unusual covertypes. Sampling data also revealed large numbers of bivalves and gastopods in the mineral sediments below the peat.

The Bonnet Lake Bog in Guysborough County is also a unique deposit to Nova Scotia although it has not been mentioned as such in earlier lists. This bog is of particular interest in that it has a large number of randomly spaced ponds separated by bands of peatland. The deposit is sloped downward from north to south, overlying several raised beaches or terraces that may be remnant shorelines of Bonnet Lake.

Common Name	Species Name	Remarks
Crested Wood Fern	*Dryopteris reginae*	common swamps and bogs
Pondweed	*Potamogeton obtusifolius* *Potamogeton natans*	rare common
Spike Rush	*Eleocharis pauciflora var Fernadii*	rare, similar to Deergrass, found im alkaline bog
Adder's Mouth	*Malaxis unifolia*	common
Hoary Willow	*Salix candida*	rare
Miterwort	*Mitella nuda*	prefers non acid soils
Showy Lady's Slipper	*Cypripedium reginae*	rare
Ludwigia	*Ludwigia palusties var americana*	common; shallow water
Water Milfoil	*Myriophyllum exalbescens*	alkaline ponds
Swamp Milkweed	*Ascelepias incarnata neoscotia*	known only in Nova Scotia
Brooklime		
White Brooklime	*Lobelia kalmii leucantha*	rare; calacreous soils
Bog Golden Rod	*Solidago uligenosa*	common
Swamp Ragwort	*Senecio Robinsii*	common
Swamp Thistle	*Cirsium mutirum*	only this nature to region
Shrubby Cinquefoil	*Potentilda futicosa*	alkaline soils
Alder Leaved Buckthorn	*Rhamnus alnifolia*	alkaline, alluvial soils

Table 3.6
Partial Species List of Black River Bog
(Nova Scotia Museum, Halifax)

			Intrinsic Value		
Bog	Name	Type / Status	Rare or Uncommon Plants	Hydrological Reserve	Representative or Unique Peatland
S6.13	Spinney Heath	Atlantic Plateau Bog (undisturbed biological preserve)	?	?	Atlantic Plateau Bog
V803	Cape Sable Island	Raised Bogs (relatively undisturbed)	?	X	X Typical
V804			?	X	Coastal
V805			?	X	X Bogs
V806			?	X	
V904	Baccaro Point Bogs	Raised Bogs	X (Drosera filiformis)	X	
T11-3	Broughms Bog	Raised Bog	?	X	X
G4101	Bonnet Lake	Raised (concentric) Bog (remote undisturbed)	?	N.A.	X
X6801	Black River Bog (IBP)	Flat, (treed alkaline) Bog (relatively undisturbed)	?	N.A.	X
X4901	Baeline Bog	Blanket Bog (Coastal) (undisturbed)	?	?	X Peat cliffs
X0873	Big Barrens Bog	Blanket Bog (Inland)	?	—	X Extreme topographic relief
X1021	Everlasting Barrens	Ladder Bog	?	—	X Parallel ridges perpeindicular to slope

?-status unknown
x-occurrence

Table 3.7
Unique or Sensitive Peatlands Surveyed, 1980-1985

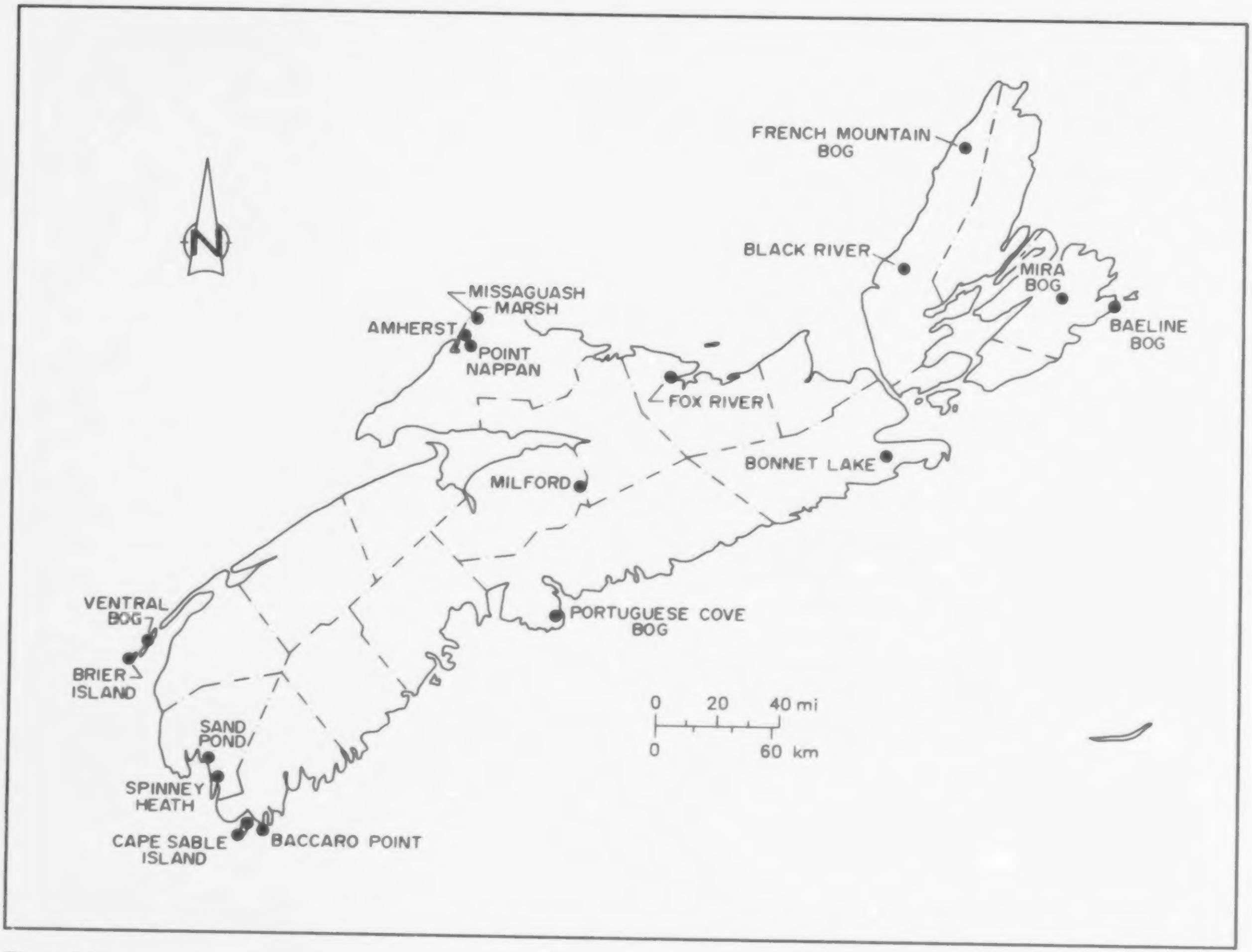

N
FRENCH MOUNTAIN BOG
BLACK RIVER
MIRA BOG
BAELINE BOG
MISSAGUASH MARSH
AMHERST
POINT NAPPAN
FOX RIVER
BONNET LAKE
MILFORD
VENTRAL BOG
BRIER ISLAND
PORTUGUESE COVE BOG
SAND POND
SPINNEY HEATH
CAPE SABLE ISLAND
BACCARO POINT
0 20 40 mi
0 60 km

Figure 3.10
Environmentally sensitive peatland areas.

Chapter 4

Summary and Recommendations

4.1 Summary

As a result of the inventory program, the total area of peatlands in Nova Scotia is now estimated to be in the order of 435,000 acres (175,390 ha). Original estimates based on soil series maps (400,000 acres, 161,810 ha) are thus still valid, assuming a ±10% variability in either estimate of resource.

Work carried out by this inventory program provided resource information for approximately 20 percent of the total peatland resource area in the Province. Roughly 81,750 acres (33 100 ha) of peatland have been surveyed, representing 267 individual deposits and 7,640 sampling sites. Data shows that distinct differences exist between peatlands in various parts of the province. Moss grade peats are very thin in southern Nova Scotia and very thick in most of the other regions, particularly in Hants County. Fuel grade peats are thickest and more highly humified in southwestern Nova Scotia than elsewhere in the Province. The thinnest fuel grade peat layers generally are found in the Highlands of Cape Breton Island.

Peatlands of inland and lowland areas are more heavily treed. Hants and Cumberland counties have some of the most heavily treed surfaces in the province.

Coastal and Highland peatlands have fewer trees and relatively higher occurrence of "*Scirpus*" lawns which often result in surficial peats which are densly permeated with *Scirpus* remnants.

Forty deposits have been presented as favourable sites for development as either fuel or peat moss operations.

Fourteen fuel grade deposits have been directly discussed, of which 13 are located in Southwestern Nova Scotia and one is located in Hants County. These deposits have a total area of 5,908 acres (2 391 ha) with an anticipated 10.37 million tons (9.43 Mte) of fuel grade peats at 50% moisture content. Considered to represent some of the best fuel peat resources in the Province, these deposits, if developed to capacity, could displace an estimated 16.57 million barrels of heating oil over the life of the harvesting operations.

Some 26 moss grade deposits have also been presented in this report as being prime candidates for the moss peat industry. Eight of the best deposits in the province are located in Hants County, three in Cumberland County, five in Guysborough County, one in Halifax County, and nine on Cape Breton Island.These deposits together amount to 8,406 acres (3 402 ha)of moss grade resource, containing roughly 14.27 million tons (13.39 Mte) of peat moss at 50% moisture content. This tonnage could represent about 275 million bales of peat moss assuming 75% recovery.

Altogether the program has surveyed 81,759 acres (33 087 ha) ofpeatland, representing calculated tonnages for deposits greater in thickness than 3 feet (1 m) of 46.4 million tons (2.2 Mte) for moss grade peats and 47.84 million tons (43.5 Mte) for fuel grade peats. If resource parameters are extrapolated to include all peatland, the total moss grade and fuel grade resources would be in the order of 410 and 380 million tons (373 and 346 Mte) respectively.

The substantial fuel peat resources in Southwestern Nova Scotia, and the large number of resource based industries now relying on oil for the major part of their energy demand, make southwestern Nova Scotia the most feasible location for the development of a fuel peat based industry.

The resources of this region and others show great promise for development into viable industries in the province. However, as most peatlands in the province exist on Crown or Crown-lease lands, it falls upon the province to manage these resources in such a way that they will provide the maximum ecological and socio-economic benefits to the region.

4.2 Recommendations

Policy

a. develop a set of guidelines or a policy which would ensurethat the maximum benefit is realized to the province from its peat resource.

b. co-ordinate efforts between the departments of Lands and Forests,Agriculture and Marketing, Environment and Mines and Energy to establish the optimum use for significant peat deposit.

Development of the Resource

a. conduct a market study to ascertain the impact and viabilityof developing peat moss and peat fuel operations in the Province and to evaluate the peat markets locally and abroad.

b. promote use of the resource to both local and non-Nova Scotian firms that would be interested in peat production.

c. ensure the provision of technical assistance to interested developers and provide incentives to parties interested in using peat for displacing imported oil.

Resource Evaluation

a. maintain a data storage, retrieval, and processing system that will allow interactive manipulation and retrieval of inventory data as well as be able to add new information as it is received.

b. develop or implement software systems that will refine primary resource inventory data to the point it can be used for delineating mineable reserves and evaluating the resource potential.

Appendix 1

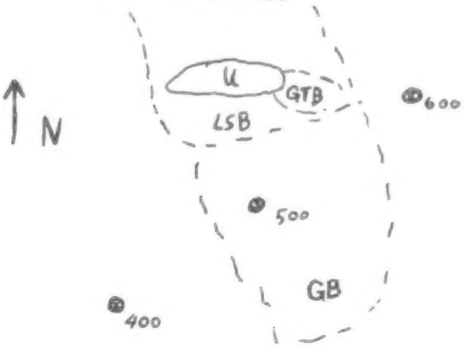
Field Sample Analysis Procedure

Squeeze Technician

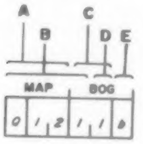
Site Analysis Procedure
(abridged from: Korpijaako & Pheeny 1977 and Modified by Anderson & Broughm 1980)

1. Location Sketch
Sketch position relative to two other survey points if present, or indicate distances relative to islands and changes in bog perimeter. Sketch in changes in surface cover between and around sites.
Example:

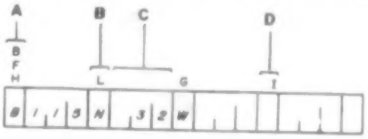
"U"	Mineral Soil/upland
"LSB"	Low Shrub Bog
"GTB"	Graminoid Treed Bog
"⊗"	Site 500



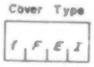
2. Deposit Identification Number
A. Map sheet code Mainland "Q12"
B. Map sheet code Cape Breton "X171"
C. Deposit Number Mainland "0-99"
D. Deposit Number Cape Breton "0-9"
E. Deposit Number sub-letter "a-g"



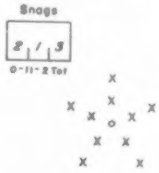
3. Sample Site Identification
A. Base line type
  B-primary grid base line
  F-secondary grid base line
  H-Tertiary grid base line
B. Relative direction of survey line (N, S, E, W)
C. Site position (10's of meters)
D. Type of side line or cross line (L, G, I)



4. Growth Form
Only three growth forms may be entered. These forms must decrease in height from left to right, ending in the right most space. Least abundant forms in each height class are entered first. A bracket is placed in front of minor occurrences. (See Radforth Growth Form key)
Eg. A low shrubby moss cover with
minor occurrences of Sedge



5. Snags
Ten probes are carried out in a five metre radius around the site with a two-metre T-bar. Information gathered is recorded as follows:
Eg. 2 Snag Hit ≤ 1 metre
  1 Snag Hit > 1 metre
  3 Snag Hit total



6. Cover Type

Peatland areas are classed according to formation (Bog, Swamp, Fen, Marsh) and type (Graminoid, Sphagnum, shrub rich treed, etc.) (See Key to Peatland Surface Types)

Eg. Graminoid Treed Bog

G	T	B
Type		

7. Micro Relief

Description of hummock size via height and width notation in decimeters.

Eg. height approximately 3 decimeters
width approximately 4 decimeters

A flat site is expressed as "10"

3	4
↕	↔

8. Site Remarks

Indicated species associated with Radforth Growth forms previously noted. (See Species Abbreviation List Identification Notes)

Cover classes are separated by slashes and are recorded in the same order as the Radforth Growth forms.

Eg. Growth Form "ADI"
Site remarks "A-species/D-species/I-species + others"

Enter the most dominant species in each class first, Minor species occurrences for a cover class are indicated using a plus sign and entered last.

Eg. Growth Form "ADI"
"A" class red maple, black spruce, plus some Tamarack
"D" class Rhodora, Blueberry-Huckleberry and some Leatherleaf
"I" class is predominantly sphagnum species plus a lot of "F" class grasses (++ = a lot)

M r S b + T a / R o B h + L i / S p + + F = C e

Site Remarks (minor cover types, species, etc.)

9. Depth of Lense

Recorded in centimeters

Eg. 1.80 meters to
2.30 meters

DEPTH (cm)	
From	To
1 8 0	2 3 0

10. Peat Type

Record relative per cent content of peat constituents utilizing recognizable features of original plants (see List of Species Identification Characteristics)

1 = 10%
0 = 100%

Eg. A...70% Sphagnum (S) content
B...10% Carex (C) content
C...10% Eriophorum (ER) content
D...10% other constituent specified as trichophorum (TR)
"N"..shrub content column
"L"..wood content column

A	B			C	D	
Peat Type %					Other	Specify
S	C	N	L	Er		
7	1			1	1	T r

11. Humification

The degree of humification is divided into ten parts (1-10) (Refer to modified von Post Humification Scale, Appendix III and Table 2.1.

Eg. Humification 5

Humification of this lense is equal to 5 on von Post scale

H	B	F	R	V
1-10	1-5	0-3	0-3	0-3
5				

12. Moisture Regime

The moisture regime of each peat sample was estimated by utilizing a scale of 1-5 and the symbol 'B',

B_1 Dry peat (Air dry)
B_2 Low moisture content
B_3 Moderate moisture content (normal)
B_4 High moisture content
B_5 Very high moisture content (mainly water)

H	B	F	R	V
1-10	1-5	0-3	0-3	0-3
	3			

13. Fine Fibre

The fine fibre content was estimated and expressed by utilizing a scale of 0-3 and the symbol 'F'. The fibres are, in this case, mainly derived from *Eriophorum*. If any other fine fibres are recorded, they should be identified in the peat formula.

F_0 Nil
F_1 Low content
F_2 Moderate content
F_3 High content

H	B	F	R	V
1-10	1-5	0-3	0-3	0-3
		1		

14. Coarse Fibre

The coarse fibres are also estimated by using a scale of 0-3 and the symbol "R" in the manner tabulated above. In this case, mainly rootlets are recorded. Often the rootlets of *Carex* or Ferns are referred to and also identified in the formula as such.

15. Woody Remnants

The presence of woody remnants in the peat may be a serious problem, especially when peat is harvested for peat moss production. For this purpose a scale of 0-3 and the symbol 'V' are used.

V_0 Nil
V_1 Low content
V_2 Moderate Content
V_3 High Content

H	B	F	R	V
1-10	1-9	0-3	0-3	0-3
				3

16. Profile Remarks

Other pertinent information is added to the end of the formula, using suitable symbols and abbreviations. Thus layers of charcoal indicating old fires, seeds, and other recognizable plant remnants, may be noted.
Eg. Some charcoal at 180, sedges and shrubs.

Remarks Minor Peat Types, Charcoal, Stumps, etc.
Char180 CBN

17. Bottom Sediments

The last items to be recorded are the possible layers of detritus, ooze, gyttja, and finally the type of bottom soil.

Eg. Rock bottom

Rock	RO
Gravel	GR
Sand	SA
Silt	SI
Clay	CL
Till	TI

Sediment
RO

Summary

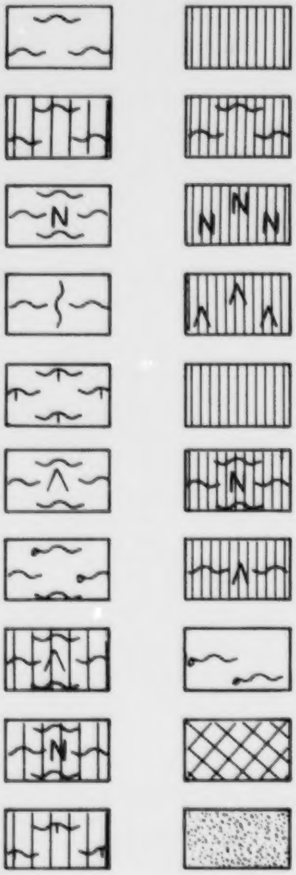
When all the information about the site has been recorded, a set of peat formulae for the site will have been created. The formulas may resemble the following:

X1246a ________	Cape Breton deposit X124-6a
B115N032W ________	Sample site 1150 meters north and 320 meters west from the origin "B00N"

$0\text{-}30C_2S_8H_3B_3R_2$ (Char 10)... first lense from surface to 30 cm in depth is 80% Shpagnum and 20% sedge with a humification of 3. The lense has a normal wetness of 3 with notable occurrences of course fibres (*Trichophorum* rootlets). An occurrence of charcoal has been noted at 10cm in depth.

LEGEND OF PROFILE SYMBOLS

Peat Types



Sphagnum Peat (S)	*Sedge Peat (C)*
Sedge - Sphagnum (CS)	*Sphagnum - Sedge (SC)*
Shrub - Sphagnum (NS)	*Shrub - Sedge (NC)*
Eriophorum - Sphagnum (ErS)	*Wood - Sedge (LC)*
Trichophorum - Sphagnum (TrS)	*Bryales - Sedge (BC)*
Wood - Sphagnum (LS)	*Shrub - Sphagnum - Sedge (NSC)*
Bryales - Sphagnum (BS)	*Wood - Sphagnum - Sedge (LSC)*
Wood - Sedge - Sphagnum (LCS)	*Bryales Peat (B)*
Shrub - Sedge - Sphagnum (NCS)	*Detritus - Ooze*
Trichophorum - Sedge - Sphagnum (TrCS)	*Clay*

Peat Humification

Von Post 1-3	*Von Post 4*	*Von Post 5-10*
⁙	▨	▧

Radforth Cover Types

A	*Tall trees (< 4.5m)*	F	*Sedges grasses (<0.5m)*
B	*Low trees (1.5 - 4.5m)*	G	*Herbs (<0.5m)*
C	*Grasses (0.5 - 1.5m)*	H	*Lichens*
D	*Tall shrubs (0.5-1.5m)*	I	*Mosses*
E	*Low shrubs (<0.5m)*	P	*Disturbed*

Jeglum Cover Types

e.g. GB, STB, LSB, (Refer. "Tri-Level Peatland classification system")

Appendix 2

Keys to the Biophysical Classification of Peatlands

Level 1

Wetland Classes

The Canada Wetland Registry (Tarnocai 1979 and 1980) has defined five distinct wetland classes: bog, fen, marsh, swamp, and shallow water. The classes are distinguished mainly by soil type, nutrient regime, and moisture regime. Of the five wetland classes, three may also be defined as peatlands. These must have a one foot (30 cm) or greater deposition of peat. For the purpose of this Peatland Inventory, only these three; bog, fen and swamp, will be considered further. The following key to wetland classes has been prepared from definitions used by the Canada Wetland Registry.

Key to Wetland Classes

A1 Main source of nutrient supply, rain water. Virtually isolated from nutrient-rich ground water. (Nutrient-poor) (ombrotrophic)

Peat covered or peat filled wetland with a high water table, at or near the surface. Develops on acid peat, forming level, raised or sloping surfaces with hummocks and wet hollows usually overlain by sphagnum and supporting a layer of ericaceous shrubs, with or without trees less than 30 feet (10 m) in height. Dominant peat materials are poorly to moderately humified *Sphagnum* and forest peat underlain at times by fen peat.

Bog

A2 Main source of nutrients through groundwater, runoff, or flowing water. Main source of nutrient supply, seepage. Restricted supply of nutrients-moderate groundwater. (Nutrient-moderate) (mesotrophic)

Peat covered or peat filled wetland with a high water table usually at or slightly above the surface. Surface relatively uniform and consolidated, occasionally with sub-parallel ridges or elevated islands, linear drainage features, and dispersed small ponds. Surface vegetation consists predominantly of sedges and brown mosses with some shrubs and at times trees less than 10 metres in height.Occurrence of *Sphagnum* is little to none. Grasses and reeds are usually associated with small ponds. Peat materials are shallow to deep, well to moderately decomposed fen peat.

Fen

A3 Main source of nutrient supply is flowing water. Subject to seasonal or periodic inundation of nutrient rich ground water. (Nutrient-rich) (minerotrophic)

B Dominant vegetation emergent, non-woody plants such as rushes, reeds, reed grasses, and sedges. Moss and tree cover are insignificant.

An unconsolidated open, flat to depressional, mineral or peat filled wetland, typically covered with clumps of emergent sedges, grasses and reeds interspersed in standing water. May have small pools and channels, or patches of bare soil exposed during seasonal water drawdowns. Often associated with open water in streams, flowage lakes, glacial depressions or marine terraces. The area has a high degree of water table fluctuation and the substratum is usually predominantly mineral material.

Marsh

B Not dominated by emergent non woody plants.

Peat filled or mineral wetland, usually having a water table at the surface. Surface flat or hummocky, usually supporting a dense cover of healthy non-stunted trees at times greater than 10 metres in height, or tall shrubs greater than 135 centimetres (herbs, grasses, ferns and brown mosses). Occasionally, *Sphagnum* mosses may dominate over brown mosses. Associated with stream courses, lake edges, subsurface drainage, glacial depressions, and bog margins. Peat mainly well decomposed forest peat, underlain at times by fen peat.

Swamp

A3 Wetlands in which 75 percent of the area is occupied by central expanses of permanent open water less than two metres in depth.

or

Wetlands where permanent open water is restricted to scattered small ponds occupying less than 75 percent of the area, or standing water is present only seasonally or not at all.

Shallow open water

Level 2
Key to Bog Forms

A) Surface raised or elevated around bordering mineral terrain

- B) surface extensive, slightly or noticably raised **Domed Bog**
- B) surface noticably raised from margins, however flat to irregular with an abundance of surface water **Atlantic Plateau Bog**

A) Surface not raised, but relatively level and concave or sloping.

- C) adjacent to a water body
  - D) surface floating mat **Floating Bog**
  - D) surface not floating **Shore Bog**
- C) Not adjacent to a water body
  - E) surface relatively flat and deposit appears to be topographically confined
    - F) bog confined to a basin, surface flat **Basin Bog**
    - F) surface concave **Bowl Bog**
    - F) bog confined in a flat depression **Flat Bog**
  - E) surface relatively flat to undulating, however appreciably sloping, not always confined to topographic depressions
    - G) unpatterned surface **Slope Bog**
    - G) patterned surface
      - H) concentric or eccentric ridges and pool formations **String Bog**
      - H) patterns of ridges and pools appear random or disjunct, surface undulating with terrain often unconfined by topography **Blanket Bog**

Key to Fen Forms

All fens found in Nova Scotia were either flat or sloping. No raised fens were recorded.

- A) Surface not raised except for low hummocks and ridges forming distinct patterns
  - B) sub-parallel to parallel ridges and furrows
    - C) broad pattern, extensive shallow peat deposit **Atlantic Ribbed Fen**
    - C) narrow ladderlike pattern, often near bog flanks **Ladder Fen**
  - B) reticulate pattern of ridges and pools **Net Fen**
- A) Surface not raised, without low hummock or ridges forming a distinct pattern
  - D) adjacent to water bodies
    - E) peat or surface of deposit floating **Floating Fen**
    - E) peat or surface in contact with underlying mineral terrain
      - F) along main channel or along banks of a semi permanent stream **Stream Fen**
      - F) along shores of semi permanent or permanent standing bodies of water **Shore Fen**
  - D) not adjacent to a water body
    - G) surface flat **Horizontal Fen**
    - G) occurring in open ended eroded stream channels **Channel Fen**

Key to Swamp Forms

- A) Adjacent to permanent or semi-permanent bodies of water
  - B) along the banks of continuously flowing streams **Stream Swamp**
  - B) along the shores of standing bodies of water **Shore Swamp**
- A) Not adjacent to permanent or semi-permanent bodies of water
  - C) confined topographically defined basins
    - D) confined to a basin like depression in the mineral terrain **Basin Swamp**
    - D) located between peatland and mineral terrain **Peat Margin or Lagg Swamp**
  - C) unconfined by topographic basins
    - E) surface relatively flat and regular
      - F) flat with uniform depth **Flat Swamp**
      - F) associated with poorly drained flood plains **Flood Plain Swamp**
    - E) occur in a stream or groundwater discharge area, irregular surface **Spring Swamp**

Level 3
Key to Peatland Surface Cover Types

The following keys to surface covertypes are abridged from Jeglum et al, (1974). Depending upon the peatlands being assessed, all covertypes will precede the peatland type. Eg. "low shrub" bog (LSB) or "low shrub" fen (LSF).

A) Trees providing less than 10% cover
  B) graminoids present, dominating any ericaceous shrubs
    C) graminoids less than 25% of cover
    Open Sphagnum Bog/Fen (SB/F)
    C) graminoids greater than 25% of cover, subdominant ericaceous shrubs or small trees
    Graminoid Bog/Fen (GB/GF)
  B) ericaceous shrubs predominanting over graminoids
    D) shrubs less than 2 feet (50 cm) providing greater than 25% cover
    Low Shrub Bog/Fen (LSB/LSF)
    D) shrubs greater than 2 feet (50cm) providing greater than 25% cover
    High Shrub Bog/Fen (HSB/HSF)

A) Trees over 8 feet (1.5m) in height providing greater than 10% of surface cover
  E) both graminoids and ericaceous shrubs making up less than 25% of understorey
  Treed Bog/Fen (TB/TF)
  E) either graminoids or ericaceous shrubs forming more than 25% of the understorey
    F) graminoid dominant
    Graminoid Treed Bog/Fen (GTB/GTF)
    F) shrub dominant
    Shrub Rich Treed Bog/Fen (STB/STF)

Open water on these deposits
Bog Pool (BP) or Fen Pool (FP)

Key to Swamp Cover Types

A) Tree or tall shrubs less than 8 feet (1.5m) high
Thicket Swamp (TS)

A) Trees or tall shrubs greater than 8 feet (1.5m) in height providing greater than 25% cover
  B) dominant tree cover 80% coniferous or deciduous
    C) coniferous
    Conifer Swamp (CS)
    C) deciduous
    Hardwood Swamp (HS)
  B) dominant tree cover less than 80% one or the other (mixed)
  Mixed Swamp (MS)

Appendix 3

Identification Notes

Appendix 3.1

Key to Radforth Cover Classification System

(Radforth 1952)

Cover Type Class	Woodiness vs. Non-Woodiness	Stature Approximate Height	Texture Where Required	Growth Habit	Example
A	woody	15 ft. or over	————	tree form	Spruce, Maple Tamarack
B	woody	5 to 15 ft.	————	young or dwarfed tree or bush	Spruce Tamarack Alder Birch, Maple
C	nonn-woody	2 to 5 ft	————	tall grass-like	Grasses Bushes, Ferns
B	woody	2 to 5 ft	————	tall shrub or very dwarfed tree	Alders Birch Labrador Tea
E	woody	up to 2 ft.	————	low shrub	Blueberry Laurel Juniper
F	non-woody	up to 2 ft.	————	mats, clumps, or patches sometimes touching	Sedges Grasses
G	non-woody	up to 2 ft.	————	single or loose association	Orchid Bake Apple Pitcher Plant Blue Flag
H	non-woody	up to 4 in.	leathery	mostly continuous mats	Lichens
I	non-woody	up to 4 in.	soft or velvety	often continuous mats, sometimes in hummocks	Mosses

Appendix 3.2

Identification Characteristics of Peat Types and Organic Constituents

Sphagnum peat		**Carex peat**	
Poorly Humified	Humified	Poorly Humified	Humified
— light yellow to yellowish brown and spongy	— dark brown soapy and elastic — makes hands dirty — no plant remains if pure	— pieces of stems, leaves etc. visible	— light to dark grey, non-soapy and not elastic — tiny rootlets and seed
Bryales peat		**Shrub peat**	
Poorly Humified	Humified		
— copper brown and shiny — individual moss specimens distinguishable stems and leaves	— non-soapy and not as elastic — no plant remains if pure	— reddish tiny, branching roots — stems and twigs	
Trichophorum spp.		**Eriophorium** spp.	
— brownish scales at base — roots round in diameter (not flat), have branches		— straight, hair-like fibres, reddish brown — root straight, very flat, light to dark brown, no branching	
Scheuchzeria		**Fern**	
— stem often curved at base, yellow to yellowish brown — leaf scars on stem close together — may give a shiny look to peat — hole in top of stem		— shiny flat brown stem pieces — crinkly hard woody branching roots, dark brown to brownish (may also be *S. cuspidatum*)	
Phragmites		**Equisetum**	
— rare large, broad pieces of stem and leaves — thick roots (compared to *Carex*) — brownish yellow to yellowish brown		— bluish black, shiny flat stems — coal black roots	
Mixed Peat Types		**Ooze**	
— do not over estimate the percentage of minor components in the peat type — if possible pick shrub pieces out of sample and compare to peat volume		— No mixtures — generally pure, fine textured material, non elastic to elastic, tan, brown or gray, may contain seeds, leaves and stems of *Carex* — may have very high silt content — usually found on bottom of deposit	

Appendix 3.3
Species Identification Notes

Eriophorum can be identified by its long, straight, reddish fibres or brown-black, flat, branchless roots. Some *Carex* species may have fibres, but they break down more easily and are not reddish. Mark down Er only when you are sure about identification.

Scheuchzeria seems to be minerotrophic in New Brunswick's climate, occurring together with *Carex* and minerotrophic *Sphagnum* species. In peat it can be identified positively by its slightly curved "underground" stems with ridge-like leaf scars. The roots look much like *Carex* roots, but are supposed to be coarser and have fewer shiny branches. Mark Sh in peat type columns only when you can make a positive identification.

Carex Species are minerotrophic. In humified peat they can be identified by "thin or shiny", light, curly rootlets with many branches. In poorly humified peat leaves are also found. They do not split into fibres as well as *Eriophorum* leaves and break easily to shorter pieces. If you are not positive about Er or Sh, call it C.

Appendix 3.4
Modified Von Post Humification Scale

H 1	Completely undecomposed peat which, when squeezed, releases almost clear water. Plant remains are easily identifiable. No amorphous material present.
H 2	Almost completly undecomposed peat which, when squeezed, releases clear or yellowish water. Plant remains still easily identifiable. No amorphous material present.
H 3	Very slightly decomposed peat which, when squeezed, releases muddy brown water, but does not pass between the fingers. Plant remains are still identifiable and no amorphous material present.
H 4	Slightly decomposed peat which, when squeezed releases very muddy dark water. No peat passes between the fingers but the plant remains are slightly pasty and have lost some of the identifiable features.
H 5	Moderately decomposed peat which, when squeezed, releases very muddy water while a very small amount of amorphous granular peat escapes between the fingers. The structure of plant remains is quite indistinct although it is still possible to recognize certain features. The residue is strongly pasty.
H 6	Moderately strongly decomposed peat with a very indistinct plant structure. When squeezed, about 1/3 of the peat escapes between the fingers. The residue is strongly pasty but shows the plant structure more distinctly than before squeezing.
H 7	Strongly decomposed peat. Contains significant amounts of amorphous material with very faintly recognizable plant structure. When squeezed, about 1/2 of the peat escapes between the fingers. The water, if any is released, is very dark and almost pasty.

H 8 Very strongly decomposed peat with a large quantity of amorphous material and very indistinct plant structure. When squeezed, about 2/3 of the peat escapes between the fingers and a small quantity of pasty water may be released. The plant material remaining consists of residues such as roots and fibres that resist decomposition.

H 9 Practically fully decomposed peat in which there is hardly any recognizable plant structure. When squeezed, almost all the peat escapes between the fingers as a fairly uniform paste.

H 10 Completely decomposed peat with no discernible plant structure. When squeezed, all the wet peat escapes between the fingers.

Appendix 3.5

Abbreviations for Bog Plant Species

Trees	
Black Spruce (*Picea mariana*)	Sb
Tamarack (*Larix larcena*)	Ta
White Pine (*Pinus strobus*)	Pw
Red Pine (*Pinus resinosa*)	Pr
Juniper (*Juniperus* spp.)	Ju
Birch (*Betula* spp.)	Bi
Alder (*Alnus rugosa*)	Al
Red Maple (*Acer rubrum*)	Mr
Aspen (*Populus* spp.)	At
Deadwood	Dw
Other	Ot
Shrubs	
Labrador Tea (*Ledum* spp.)	Lt
Inkberry (*Ilex glabra*)	Ib
Bog Rosemary (*Andromeda* spp.)	Rb
Laurel (*Kalmia* spp.)	Ka
Leather Leaf (*Chaaedaphne* spp.)	Ll
Rhodora (*Rhododendron* spp.)	RO
Cranberry (*Vaccinium* spp.)	Cb
Blueberry & Huckleberry (*Vaccinium* spp.)	Bh
Wild Raisin (*Viburnum* spp.)	Vi
Indian Pear (*Amelanchier* spp.)	Ip
Sweetfern (*Comptonia* peregrina)	Sf
Sweetgale (*Myrica gayle*)	Sg
Crowberry (*Empetrum nigrum*)	Cr
Bearberry (*Arctostaphylos* spp.)	Bb
Willow (*Salix* spp.)	Wi
Other	Os
Grass-like Plants	
Carex spp.	Cx
Eriophorum	Er
Eriophorum angustifolia	Ea
Eriophorum spissum	Es
Eriophorum virginicum	EV
Scirpus caespitosus	Tr
Phragmites	Pg
Scheuchzeria	Sh
Pitcher Plant (*Sarracenia purpurea*)	Pp
Sundew (*Drosera* spp.)	Sd
Skunk Cabbage (*Symplocarpus* spp.)	Sc
Orchids (Orchidaceae)	Or
Golden Rod (*Solidago* spp.)	Gr
Bake Apple (*Rubus* spp.)	Ba
Iris (Blue Flag) (*Iris* spp.)	Bf
Other	Og
Mosses	
Sphagnum	Sp
Bryales	Br
Other	Om
Ferns	Fr
Lichens	Li

Appendix 4

Guidelines for a Management Policy for Crown Peatlands

The conflict between increased exploitation of North American peat, for horticultural and indigenous energy purposes, and wildlife production, crop production, and recreational activities (hunting and nature appreciation), has led to a need for a planned management of peatlands. Several jurisdictions in Canada, and in the U.S. have comprehensive legislation or policies that protect and manage their peat resources in such a way as to allow for multi-use planning.

To date, pressures to exploit Nova Scotia peatland areas have been minimal. However the extent of peatland resources outlined in this report, and the broad variety of implications that can result from peatland development in these areas, may well increase pressures to manage the resource, even over the next decade.

The majority of Nova Scotia's peatlands lie on Crown or crown-lease lands. Therefore it falls upon the Province to manage or direct activities associated with these activities to ensure protection or proper use of peatlands and to ensure that the maximum return for this valuable resource is realized.

Since peat occurs at the surface of the land, it is not classed as a mineral and as such is administered through the Department of Lands and Forests. This department would ultimately be responsible for devising a policy of peatland management.

Peatland value lies in three fairly distinct areas of concern:

1. wetland ecosystems
2. in situ utilization
3. peat extraction

The best way to effectively deal with these concerns, is to implement a peatland policy which first evaluates the ecological sensitivity and value of the specific deposits to the environment. Only when it has been determined that development of the peatland area would not cause significant detrimental effects to the surrounding environment, should development of the bog or peat deposit be considered.

In such a policy, developers of peatlands (either for in-situ use or for peat extraction) should be held responsible for environmental impacts resulting from their operations. Upon abandonment, they should also beresponsible for rehabilitation of the site, either through conscientious effort or performance bonds held by the Province.

Peat is a valuable resource that requires a policy strategy that is flexible enough to allow for the proper use or non-use of individual peatland areas, as well as to provide a base for the control of revenues, dissemination of permits and licenses and environmental protection. Such a policy should reflect the multi-use possibilities of peatlands and strive to:

1. Ensure maximum and optimum contribution to the Provincial economy,
2. Ensure the conservation or preservation of sensitive ecosystems of flora or fauna,
3. Ensure sound production and management practices that provide for:
   a. the optimum and most efficient use of a peatland;
   b. future rehabilitation and utilization; and
   c. non-interference with neighbouring operations or the expansion into sensitive areas nearby,
4. Ensure that privately owned peatlands are as financially attractive to develop as those owned by the Province, and
5. Ensure environmental responsibility is taken by the developers with regard to fire protection and air and water quality arising from the development and utilization of peatlands.

Crown peatlands leased to developers would be protected and maximum benefits to the Province realized through a policy that would screen applications for development. Before a lease of a peatland would be considered:

1. the applicant should provide:
   a. proof of financial capability to be able to carry out work required under the license and provide a plan for development and production, and
   b. assurance that sufficient resource exists to sustain their operation.

The applicant(s) should then apply for an exploration license.

A license would be granted:

1. if payment of a fee for application or renewal,
2. if no other peatland exploration license is held by the applicant,
3. if a detailed outline of exploration program provided,
4. if exploration proposals cover less than 1000 ha,
5. if the proposal does not interfere or jeopardize the future availability of the peat resource for existing or neighbouring lease holders,
6. if it ensures a fair return to the Province for its resource as well as providing an avenue for the administration of tenure collection of revenues based on a dollar or intrinsic value of the resource, and
7. if it reduces land speculation and resource hoarding.

The infrastructure for the administration of such a policy exists within the Department of Mines and Energy and the Department of Lands and Forests. The development of a comprehensive policy would serve to simplify the administration of tenure, would ensure equal and fair treatment of prospective developers, and serve to attract developers to the Province as well protect the resource and the wetland environment of Nova Scotia.

Bibliography

Agriculture Canada, 1974. Agroclimatic Atlas. Agrometeorology Research and Service Section, Chemistry and Biology Research Institute, Ottawa, Canada, Technical Bulletin No. 81.

Anderson, A.R., and W. A. Broughm, 1980 Preliminary Assessment of the Peat Resources of Southwestern Nova Scotia, N.S. Dept. of Mines and Energy unpublished report.

Anrep, A., 1911. Investigation of Peat Bogs and Peat Industry of Canada. Mines Branch, Dept. of Mines and Energy, Canada, Technical Bulletin No. 151.

Asplund, D., and J. Okkonen, 1982. The Peat Industry in Finland. *In*, T. E. Tibbetts, P. G. Telford, and W. Shotyk, eds., Peat- An Awakening Natural Resource. Proceedings of a Symposium held in Thunder Bay, Ontario, Canada, October 26-28, 1981. The Canadian National Committee, International Peat Society (CNC-IPS).

Auer, V., 1930. Peat Bogs in Southwestern Canada. Canada. Department of Mines, Memoir No. 162.

Bardecki, M.J., 1984. "What Value Wetlands". Journal of Soil and Water Conservation, May-June, 1984. p. 166.

Barber, K. E., 1981. Peat Stratigraphy and Climatic Changes. A. A. Balleema, Rotterdam.

Bedard, E., 1983. Survey of the Horticultural Peat Industry in Canada. *In*, J. D. Sheppard, J. Musial and T. E. Tibbets, eds., Symposium '82, Proceedings of a Symposium on Peat and Peatlands. Shippegan, New Brunswick, Canada, September, 1982. Canadian National Committee, International Peat Society (CNC-IPS).

Boville, B.W., R.E. Munn, and F.K. Hare. 1983. Final Report-The Storage of Non-living Organic Carbon in Boreal and Arctic Zones-Canada. Institute of Environmental Studies, U.S. Dept. of Energy, Washington. University of Toronto Press, Toronto, Ontario, Canada.

Callanan, P.F., 1972. Peat Production in Ireland. *In*, Proceedings of the 4th International Peat Congress I-IV, Helsinki, 1972.

Cann, D.B., and J. D. Hilchey, 1959. Soil Survey of Queens County, Nova Scotia. Canada Dept. of Agriculture and Nova Scotia Dept. of Agriculture and Marketing, Nova Scotia Soil Survey, Truro, Nova Scotia, Report No. 8.

Cann, D.B., J.D. Hilchey, and G.R. Smith, 1954a. Soil Survey of Hants County, Nova Scotia. Canada Dept. of Agriculture and Nova Scotia Dept. of Agriculture and Marketing, Nova Scotia Soil Survey, Truro, Nova Scotia, Report No. 5.

Cann, D.B., J.D. Hilchey, and G.R. Smith, 1954a. Soil Survey of Cape Breton Island, Nova Scotia. Canada Dept. of Agriculture and Nova Scotia Dept. of Agriculture and Marketing, Nova Scotia Soil Survey, Truro, Nova Scotia, Report No. 12.

Chornet, E., 1984. Peat Options for the Future. *In*, Symposium '83 Energy from Peat. Proceedings of a Symposium held at St. John's, Nfld., September 18-22, 1983. Newfoundland-Labrador Peat Association and The Canadian National Committee, International Peat Society (CNC-IPS).

Dansereau, P., and F. Segados-Vianna, 1952. Ecological study of the peat bogs of eastern North America. I. Structure and evolution of vegetation. Canadian Journal of Botany 30: 490-520.

Davis, R.B., G.L Jacobsen, Jr., E.R. Sorensen, L.S. Wifoff, and A.Zlotsky. Maine's Freshwater peatlands. Typology and distribution. Department of Botany and Plant Pathology and Institute for Quarternary Studies, University of Maine, Orono, Maine, U.S.A.

Fushman, C.H., 1980. Peat: Industrial Chemistry and Technology. Center for Environment Studies, Bemidji State University, Minnesota. Academic Press, Toronto.

Haanel, B.F., 1926. Peat, Its Manufacture and Uses. Final Report of the Peat Steering Committee. Government of the Dominion of Canada and Province of Ontario, Mines Branch No. 61.

Hilchey, J.D., D.B. Cann, and J.I. MacDougall, 1964. Soil Survey of Guysborough County, Nova Scotia. Nova Scotia Dept. of Agriculture and Marketing and Canada Dept. of Agriculture, Nova Scotia Soil Survey, Truro, Nova Scotia, Report No. 14.

Jeglum, J.K., A.N. Boissonneau, and V.F. Haavisto, 1974. Toward a Wetland Classification for Ontario. Canadian Forestry Service, Sault St. Marie, Canada, Information Report No. 0-X-215.

Keppie, J.F., 1979. Geological Map of Nova Scotia, 1:500,000. Nova Scotia Department of Mines and Energy and Canadian Dept. of Regional Economic Expansion.

Keys, D., R.D. Henderson, 1983. Field and Data Compilation Methods used in the Inventory of Peatlands of New Brunswick, Canada. *In*, P.M. Jarrett ed., Testing of Peats and Organic Soils. American Society for Testing and Materials, Philadelphia, Special Technical Publication No. 820.

Kivinen, E., and P. Pakarinen, 1980. Peatland areas and the Proportion of Virgin Peatland in Different Countires. *In*, Proceedings of the 6th International Peat Congress, Duluth, Minnesota, U.S.A.

Kopstein, M., 1979. Peat Prospectus. U.S. Dept. of Energy, Washington, D.C.

Korpijaakko, E., and P. Pheeny, 1972. Peatland Survey Methods. New Brunswick Department of Natural Resources. Topical Report No. 77-4.

Leverin, H.A., 1946. Peat Moss Deposits in Canada. Dept. of Mines andand Resources, Ottawa, Canada, Report No. 817.

Leverin, H.A., and J.R. Cameron, 1949. Peat and Peat Mosses in Nova ScotiaNova Scotia Dept. of Mines Report.

Maritime Resource Management Service and Griffiths-Muecke Associates, 1984. Natural History of Nova Scotia. II. Regions. Nova Scotia Department of Lands and Forests and the Nova Scotia Museum, Dept. of Education, Halifax, Nova Scotia.

MacDougall, J.I., D.B. Cann, and J.D. Hilchey, 1961. Soil Survey of Shelburne County, Nova Scotia. Canada Dept. of Agriculture and Nova Scotia Dept. of Agriculture and Marketing, Nova Scotia Soil Survey, Truro, Nova Scotia, Report No. 10.

McNearney, M.J., 1982. The Irish Peat Industry-1981. *In*, Peat-An Awakening Natural Resource. Proceedings of a Symposium held in Thunder Bay, Ontario, Canada, October 26-28, 1981. The Canadian National Committee, International Peat Society (CNC-IPS).

Monenco Ontario Limited, 1981. Evaluation of the Potential of Peat in Ontario. Energy and Non Energy Uses. Ontario Ministry of Natural Resources, Toronto, Ontario, Canada, Occasional Paper No. 7.

Moore, P.D., and D.J. Bellamy, 1974. Peatlands. Springer-Verlag, New York.

Moores, W., 1983. Peat-An Awakening Giant. Symposium '82, Proceedings of a Symposium on Peat and Peatlands. Shippegan, New Brunswick, Canada, September, 1982. Canadian National Committee, International Peat Society (CNC-IPS).

Nowland, J.L., and J.I. MacDougall, 1973. Soils of Cumberland County, Nova Scotia. Canada Dept. of Agriculture and Nova Scotia Dept. of Agriculture and Marketing, Nova Scotia Soil Survey, Truro, Nova Scotia, Report No. 17.

Ogden, J.G. III, 1960. Recurrence surfaces and pollen stratigraphy of a post-glacial raised bog, Kings County, Nova Scotia. American Journal of Earth Science 258: 341-353.

Pollet, F., 1968. Peat Resources of Newfoundland. Mineral Resources. Dept. of Mines, Agriculture and Resources, St. John's, Newfoundland, Report No. 2.

Punwani, D.V., 1980. Executive Conference Proceedings, Management Assessment of Peat as an Energy Resource. Presented July 22-24, 1979. Peat an an Energy Alternative: An Overview. Arlington, Virginia, Institute of Gas Technology, Chicago.

Radforth, N.W., 1952. Suggested classification of muskeg for the engineer. The Engineering Journal 35: 1199-1210.

Railton, J.B. 1972. Vegetation and Climatic History of Southwestern Nova Scotia in Relation to a South Mountain Ice Cap. Phd. Thesis, Dalhousie University, Halifax, N.S.

Railton, J.B., 1975. Post-glacial History of Nova scotia. *In*, Environmental Change in the Maritimes, *In*, H.G. Odgen III and M.J. Harvey, eds, Proceedings and Transactions of the Nova Scotia Institute of Science, 27 (Supplement 3): 37-42.

Scagel, R.F., R.J. Bandini, G.E. Rouse, W.B. Schofield, J.R. Stein, and T.M.C. Taylor, 1965. Plant Diversity: An Evolutionary Approach. Wadsworth Publishing Co. Inc. Belmont, California.

Statistics Canada, 1985. Domestic Exports by Province. 65004, unpublished data, Statistics Canada, Halifax, Nova Scotia.

Stea, R.R., 1982. Pleistocene Geology and Till Geochemistry of South Central Nova Scotia. Sheet 6. Nova Scotia Dept. of Mines and Energy and Canada Dept. of Regional Economic Expansion, Map 82-1.

Stea, R.R., and D.R. Grant, 1982. Pleistocene Geology and Till Chemistry of Southwestern Nova Scotia Sheets 7 & 8. Nova Scotia Department of Mines and Energy and Canadian Dept. of Regional Economic Expansion, Map 82-10.

Stea, R.R., and J.H. Fowler, 1979. Minor Trace Variations in Wisconsin Tills, Eastern Shore Region Nova Scotia. Nova Scotia Dept. of Mines and Energy and Canada Dept. of Regional Economic Expansion, Paper 79-4.

Stea, R.R., and J.H. Fowler, 1981. Pleistocene Geology and Till Geochemistry, Central Nova Scotia. Nova Scotia Dept. of Mines and Energy and Canada Department of Regional Economic Expansion, Map 81-1.

Sutherland, D.R., and F.S. Shea, 1976. Assessment of the Peat Moss Occurrences in Guysborough, Antigonish, Pictou, Colchester, and Cumberland Counties, Nova Scotia. Nova Scotia Dept. of Mines and Energy, Halifax, Nova Scotia, Bulletin No. 3.

Swinnerton, A.A., 1958. Peat Moss in Canada. Dept. of Mines and Technical Surveys, Ottawa, Canada. Information Circular No. 104.

Tarnocai, C., 1979. Canadian Wetland Registry. *In*, C.D.A. Rubec and F.C. Pollett eds., Proceedings of a workshop on Canadian Wetlands, Environment Canada, Ottawa, Canada, Ecological Land Classification Series No. 12.

Tarnocai, C., 1980. Development, Age and Classication of Canadian Peatlands. Proceedings of a workshop on Organic Soil Mapping and Interpretation in Newfoundland. May 26-29, 1980, St. John's, Newfoundland. Agriculture Canada, Land Resource Research Institute, Ottawa, Ontario, Canada.

Tarnocai, C., 1984. Peat Resources of Canada. Land Resource Research Institute, Agriculture Canada, NRCC No. 24140.

Technopeat Inc., 1984. Feasibility Study to Determine the Potential Fuel Peat for an Industrial Utilization in Southwestern Nova Scotia. N.S. Dept. of Mines and Energy, Halifax, Nova Scotia.

Tibbetts, T.E., and J.A. Fraser, 1978. The Utiliation of Canadian Peat as an Alternate Energy Source. Canadian Institute of Mining Bulletin, September 1978.

Valmet Oy, M.S. Water Suction Dryer. A new production technology. Valmet Oy, Turku, Finland, unpublished report.